Rafferty - Alameda Project

Summary

Initial Environmental Evaluation

Environment Canada
Conservation and Protection

Environnement Canada
Conservation et Protection

Canada

RAFFERTY-ALAMEDA PROJECT

SUMMARY REPORT

OF THE

INITIAL ENVIRONMENTAL EVALUATION FOR

ENVIRONMENT CANADA CONSERVATION AND PROTECTION

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LIST OF ACRONYMS

COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CLI	Canada Land Inventory
dam^3	cubic decametres (1 decametre=10 metres)
EARP	Environmental Assessment and Review Process
EIS	Environmental Impact Statement
FSL	full supply level
IEE	Initial Environmental Evaluation
IJC	International Joint Commission
IRIA	International River Improvements Act
m^3/s	cubic meter per second
MW	megawatt
NAWMP	North American Waterfowl Management Plan
NWPA	Navigable Waters Protection Act
NWR	national wildlife refuge
RSCC	Regional Screening and Coordinating Committee
SBDA	Souris Basin Development Authority

BACKGROUND

The Souris River basin is prone to both drought and flooding, and provision of an assured water supply has been a major challenge for residents since the area was first settled. Flood damage control and drought proofing have always been of prime concern but, more recently, water resources management has been viewed as a key to future economic and industrial diversification in southeastern Saskatchewan.

The Rafferty-Alameda Project (hereinafter referred to as "the Project") is the most recent water management proposal to be considered for the area by the province of Saskatchewan. This Project would dam the Souris River and a tributary, Moose Mountain Creek, creating two reservoirs. Associated downstream channel modifications and a diversion channel would integrate the new works into the present water control system. The Project would facilitate water management in the basin by storing spring run-off and storm waters to provide flood control and water for irrigation, and recreational opportunities. Rafferty Reservoir is also intended to provide cooling water for the proposed Shand Thermal Generating Station.

Planning of the Project proceeded from 1984 to early 1988 in accordance with provincial regulatory requirements. Final provincial approval for the Project was granted in February 1988, and preliminary construction work began in March 1988.

The Souris is an international river, and therefore, the Project requires a federal licence under the International River Improvements Act (IRIA). Licensing under the Act ensures that improvements on the river will serve the long term interests of Canada. The licence for the project was granted to the province of Saskatchewan by the federal Minister of the Environment on June 17, 1988, following review by federal departments of the Project's Environmental Impact Statement (EIS). The Environmental Impact Statement was prepared by the Project's Proponent, the Souris Basin Development Authority (SBDA), in accordance with provincial environmental regulations. The IRIA licence was conditional on compliance with several stipulations that, when met, would satisfy federal concerns in areas of federal responsibility.

On April 10, 1989, the Federal Court of Canada quashed the IRIA licence and ordered the federal Minister of the Environment to comply with the Environmental Assessment and Review Process (EARP) Guidelines Order in considering the application of the Saskatchewan Water Corporation for a licence under the IRIA. Six areas of federal responsibility that were to be considered under EARP were identified by Environment Canada. These were:

- transboundary water issues arising from Canada's obligations under Canada/U.S. treaties and/or related to the protection of the interests of downstream users;
- protection of migratory birds and their habitat;
- protection of fish and fish habitat;
- federal lands;
- protection of rare and endangered species and their habitat; and
- protection of navigable waters.

This document is a **summary** of the Initial Environmental Evaluation (IEE) prepared by Canada for the Project. It has been prepared to provide the public with a broad overview of the Project and its potential impacts on areas of federal responsibility. Subsequent sections of the summary provide more information on the six areas of interest. The Executive Summary of the IEE has been included as an Appendix.

A draft IEE was prepared by Environment Canada for public review. The draft IEE presented technical information on the nature, extent and significance of potential project impacts, mitigation measures, residual impacts and information deficiencies. A series of public meetings were held throughout the Souris basin and individuals and groups were invited to attend.

Written and oral briefs were accepted. The comments and concerns expressed by the public were then incorporated into the recommendations and conclusions of the final IEE.

The final IEE and its recommendations were forwarded to the Minister of the Environment to guide his decision on licencing the Project under the International Rivers Improvements Act.

THE FEDERAL ENVIRONMENTAL ASSESSMENT AND REVIEW PROCESS

The Federal Environmental Assessment and Review Process (EARP) exists to ensure that federal projects, programs and activities, and any other proposals that may have an environmental effect on areas of federal responsibility, undergo assessment early in their planning stages to ensure that environmental effects and implications are taken into account. The 1984 EARP Guidelines Order establishes the process and sets out the requirements, procedures and responsibilities of the participants. The process is one of self-assessment - every federal department, and therefore every federal minister, is responsible for applying the EARP to proposals that affect their areas of decision-making responsibility.

The EARP can be viewed as occurring in two phases: initial assessment and public review by a Panel. The department initiating the review retains the decision-making power to either proceed to the next step of the process, abandon the project or approve the project if environmental, social and economic criteria are satisfied during any phase of the review.

The initial assessment phase is intended to be a screening process: it provides a brief, systematic documented assessment of environmental implications of a proposal, including adverse effects, potential mitigation actions, and information deficiencies. The document is normally referred to as an Initial Environmental Evaluation (IEE).

If adverse effects and/or public concerns are significant, then a decision by the Minister of the initiating department may be made to enter into the second and final phase by referring the proposal to the Minister of the Environment for review by a Panel. A Panel review would entail further investigations, such as an EIS, as well as public meetings.

What are the specific objectives of the Rafferty-Alameda IEE?

The Rafferty-Alameda IEE has been prepared to provide information to the public on the extent and significance of the Project's potential environmental impacts on areas of federal responsibility. It also identifies mitigation measures that may be applied to offset any undesirable impacts and identifies data gaps that limit the federal government's ability to assess impacts with confidence.

What are these areas of federal responsibility?

The British North America Act, as part of the Canadian Constitution, defines the division of powers and responsibilities between the federal and provincial levels of government and gives the provinces control over property and civil rights. The provinces also control the management and sale of public lands within their boundaries, electrical generating works, and 'matters of a local or private nature'. As water is traditionally defined as property, it falls under provincial jurisdiction, hence the province of Saskatchewan's involvement throughout all stages of the Project.

In specific areas, however, provincial jurisdiction is overridden by exclusively federal powers. These powers relate to fisheries, navigation, migratory birds, relations with foreign governments, federal lands, Indians, 'works for the general advantage of Canada,' and matters relating to 'peace, order and good government'. In relation to the Project, these responsibilities can be summarized under the following headings:

International Waters: Canada has authority over transboundary waters under the Boundary Waters Treaty of 1909. Canada's authority also arises from Canada - U.S. agreements and arrangements. The federal government is obligated to ensure that water quantity is maintained and improvements or control structures do not adversely affect downstream users, in this case, North Dakota and Manitoba.

Migratory Birds: Canada is responsible for protection of migratory birds and their habitat under the Migratory Birds Convention Act. Riverine areas in the Souris basin provide habitat for migratory birds, and the Project has the potential to alter that habitat.

Fish and Fish Habitat: Canada has responsibility for protection and management of fish and fish habitat under the federal Fisheries Act and may regulate activities that could alter flows or affect water quality in any way that may harm fish. The Project has the potential to affect water levels and water quality in the Souris River and other reservoirs and streams.

Rare and Endangered Species: Canada has no direct mandate for protection of rare and endangered species, but it cooperates with other governments on a national and international level in their conservation and protection efforts, partly through the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Eleven species of birds and mammals classified as nationally rare or endangered have been recorded in the Souris River basin. Nineteen nationally significant plant species have also been recorded in the basin.

Navigable Waters: The federal government, through Transport Canada, administers the Navigable Waters Protection Act (NWPA). Any project that may affect navigation on a navigable waterway (such as the Souris River) must apply to the Minister of Transport for a licence under the Act.

Preparation of the IEE

Within these areas of federal responsibility, information pertaining to the Project was reviewed by a federal inter-departmental task force lead by Environment Canada to assess possible adverse impacts and to identify areas where additional information was required.

Information was received from the SBDA, provincial agencies in Saskatchewan and Manitoba, the U.S. Army Corps of Engineers, and from existing Environment Canada studies. Additional information was extracted from public meeting summaries pertaining to the Project, reviews of recently published, and unpublished material, reviews of similar projects, and consultations with individuals knowledgeable in relevant areas. In areas where information was not readily accessible, a variety of techniques was used to fill data gaps. For example, modelling studies to determine the effects of water quantity and quality changes at the two Souris River crossings of the international boundary were undertaken.

Pertinent information was then synthesized into a draft IEE. The draft was extensively reviewed to identify deficiencies, and reviewers' comments were incorporated into the final document. The IEE presents information on environmental impacts affecting federal interests, identifies possible methods of mitigation, and identifies data gaps in the available information base. Particular emphasis is placed on impacts related to the Minister of the Environment's regulatory responsibility under the IRIA. The draft IEE constituted the first step in federal environmental review of the Project.

Table 1: Public Meetings

Saskatchewan:	
Regina	June 22, 1989
Oxbow	June 23, 1989
Estevan	June 24, 1989
Manitoba:	
Melita	June 26, 1989
Souris	June 28, 1989
Brandon	June 29, 1989
North Dakota:	
Minot	June 27, 1989

PUBLIC INVOLVEMENT

The second stage in the federal review of the Project was the solicitation of public concerns relating to the draft IEE in particular, and the Project in general. Public meetings were held by Environment Canada throughout the Souris River basin from June 22 to June 29, 1989. Meeting locations and dates are presented in Table 1. Prior to each meeting, an 'open house' was held where the public could meet and discuss specific concerns with the scientists who prepared the draft IEE. The public meetings were chaired by an independent moderator who has submitted his report to the Minister. As well, a transcript of all the briefs presented is contained in the Public Consultation Process Volume of the IEE.

In total, 281 written and verbal briefs were presented at the meetings or directly to Environment Canada. A majority of the Canadian briefs support the Project (187 for - 58 against). Proponents overwhelmingly cited water management and economic benefits associated with the Project. In addition, they felt that the mitigation plan prepared by the SBDA was more than adequate. Opponents to the Project cited issues such as sustainable development, assessment of Project alternatives, and downstream impacts, especially to Manitoba, as the basis for their opposition. At the Minot, North Dakota meeting, 26 of the 28 briefs presented supported the Project. As well, Environment Canada received eight impartial responses to the draft IEE. A summary of the issues raised is presented in the Public Review Process section of this document.

The majority of issues raised, by both proponents opponents, pertained to the broad subjects of basin-wide water management, regional economic development and diversification and sustainable development. Public concerns which related to the technical issues presented in the draft IEE were incorporated into the final IEE. The technical findings of the IEE, the briefs submitted by the public, and the moderators report were all prepared to provide advice to the Minister in his role as the Minister responsible for licensing under the International River Improvements Act.

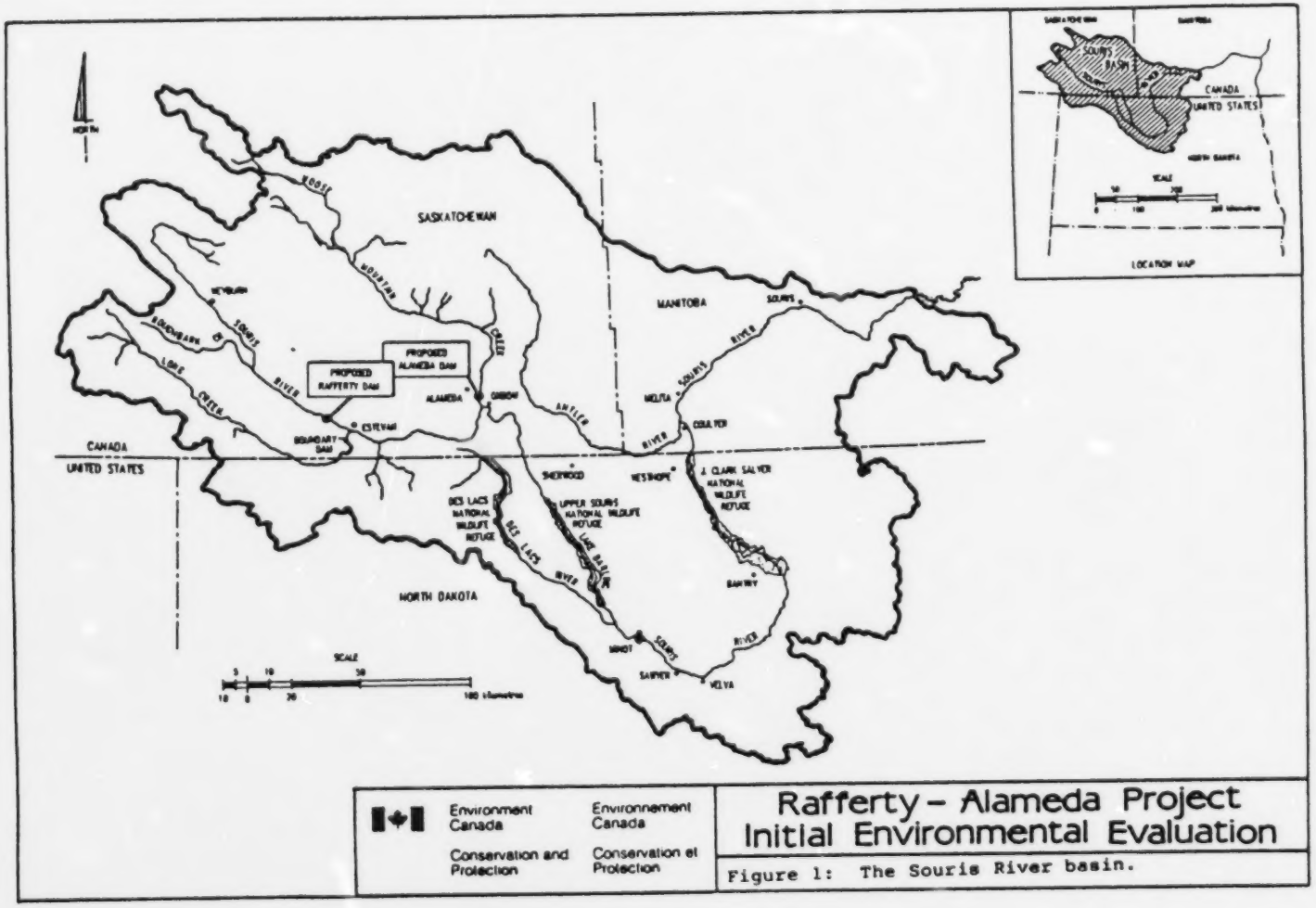
SASKATCHEWAN
MANITOBA
PROPOSED RAFFERTY DAM
PROPOSED ALAMEDA DAM
RAFFERTY
ALAMEDA
GRANT
SOURIS
MOOSE MOUNTAIN CREEK
LONG CREEK
SOURIS RIVER
BOUNDARY DAM
ESTEVAN
CANADA
UNITED STATES
NORTH DAKOTA
MELITA
COULTER
SHERWOOD
WESTHOPE
J. CLARK SALYER NATIONAL WILDLIFE REFUGE
UPPER SOURIS NATIONAL WILDLIFE REFUGE
DES LACS NATIONAL WILDLIFE REFUGE
DES LACS RIVER
LAKE DARLING
BANTRY
MINOT
SOURIS RIVER
SAWYER
VELVA
SCALE
LOCATION MAP
Environment Canada
Conservation and Protection
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Figure 1: The Souris River basin.

Project Setting

The Souris River is an international river that rises in Saskatchewan, flows into the United States and then into Manitoba. Figure 1 shows the Souris River basin area. The total length of the river is approximately 1170 km, and the basin encompasses approximately 62 120 km^2.

The Souris River valley is essentially flat and shallow, averaging less than 30 m in depth and the river channel varies from 2 to 8 m in depth. The main river channel meanders across the valley floor, and in many areas, the river banks are low and poorly defined. As a result, extensive flooding occurs in the valley during high spring runoff periods.

The climate in this region is semi-arid continental, exhibiting extremes in temperature and precipitation. Periods of drought, torrential thunderstorms and intense heat or cold are typical of the region. Annual evaporation and plant transpiration normally exceeds precipitation; as a result the region usually experiences an annual soil moisture deficit.

Most of the Souris River basin has been cultivated and only the national wildlife refuges and those areas unsuitable for agriculture have retained the native vegetation. In the southwest portion, the native vegetation consists of mixed-grass prairie. Towards the north and east, as moisture levels increase, the vegetation changes to parkland, aspen forest and tall-grass prairie.

Water Management History

As an international river, the Souris is subject to the Boundary Waters Treaty of 1909 which establishes the basic principles regarding the use and management of international waters between Canada and the United States. Under the Treaty, the International Joint Commission (IJC) was established to administer the Treaty and to consider other matters referred by government. Through the aegis of the IJC, water apportionment measures have been adopted for most of the streams that cross the international boundary in the semi-arid mid-continent area.

The 1959 Interim Measures specified that Saskatchewan would pass 50 percent of the natural flow of the Souris River, as measured at Sherwood Crossing, to North Dakota. Since 1959 Saskatchewan has retained 16 percent of the average annual flow each year. In fact, the total volume of water passed to the United States for the entire 1959 to 1988 period is equal to 101 percent of the total natural flow. The Project would develop Saskatchewan's storage capacity to retain flows to which it is entitled under the 1959 Interim Measures. Under the same Measures, Manitoba is guaranteed a minimum flow of 0.566 m^3/s from June to October inclusive.

Stream flow records for the Souris River show large seasonal and annual variations in flow volumes. Because flows are highly dependent on spring runoff, in dry years little or no flooding occurs while wet years are associated with

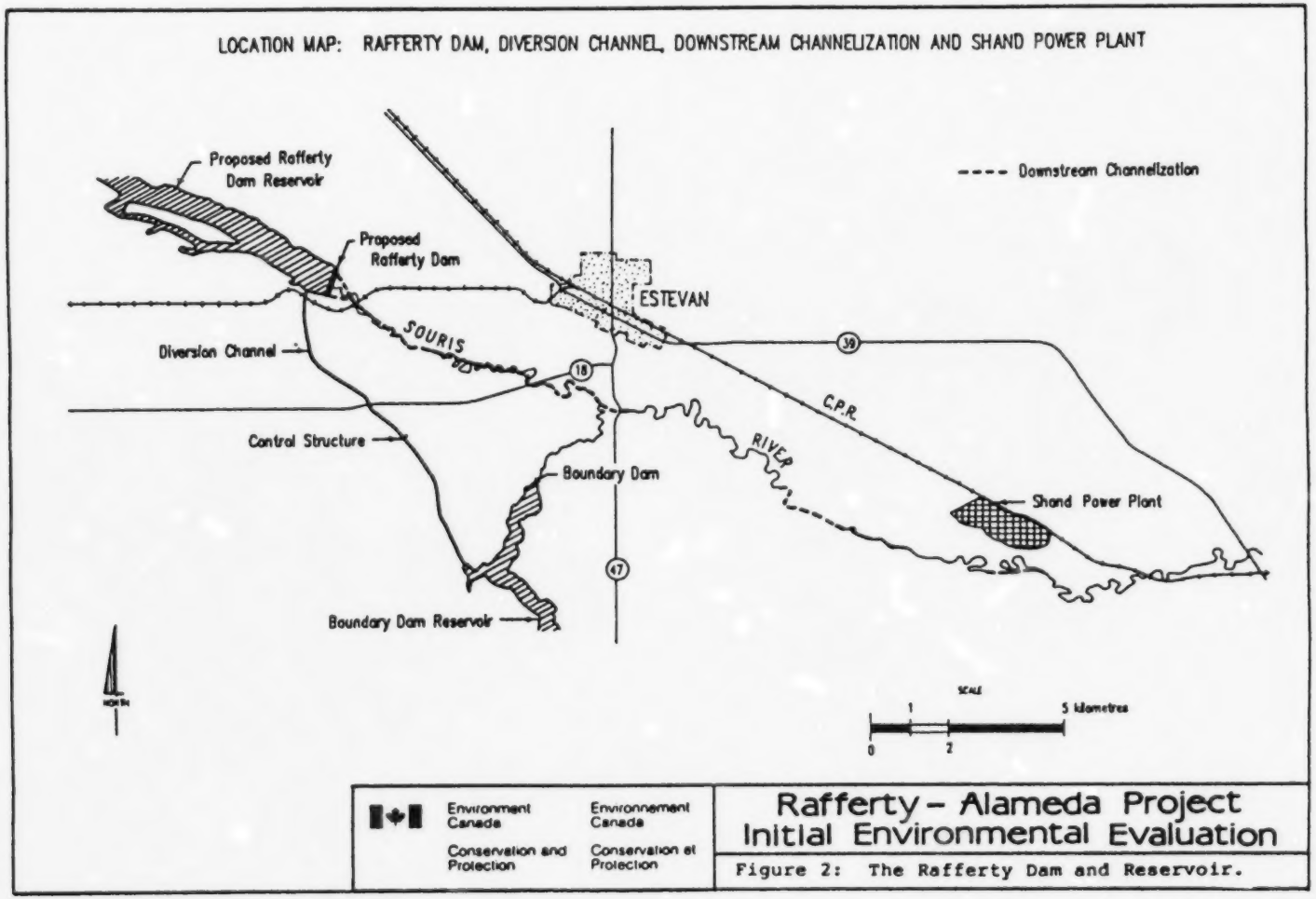


Figure 2: The Rafferty Dam and Reservoir.

extreme flood conditions. Floods on the Souris have been recorded since 1882. In five years between 1969 and 1979, flooding resulted in major crop and property damage in the Souris River basin. After the spring flood season, it is not unusual to record zero flow during a dry summer. Management of this erratic water supply has long been viewed as a prerequisite to economic prosperity within the basin.

Since homesteading began in the basin, water control structures have been proposed, although serious consideration was not given to major works until the 1930s. However, no construction occurred. In the 1970s, the Souris River Basin Study was conducted jointly by the governments of Saskatchewan, Manitoba and Canada. This study identified a strong local interest in a water storage and control structure on the Souris River. It concluded that such a project would only be viable with a major industrial user. In the 1980s, several events combined to make the development of a dam on the Souris River a possibility: the government of Saskatchewan determined that water-based resources were a key component in a provincial economic diversification strategy; the Saskatchewan Power Corporation identified the construction of the Rafferty Dam as a necessary structure for supplying cooling water to a proposed 600 megawatt (MW) thermal electric generating station in the Estevan area; and the United States indicated an interest in expanding the Project, on a cost-sharing basis, to provide flood protection for the city of Minot, and other areas in North Dakota.

As a result, a multi-purpose reservoir and storage facility was planned for the Souris River. The Project was designed to provide flood protection for basin residents in Saskatchewan and for the city of Minot, North Dakota, to supply water for the Shand Thermal Generating Station, and to provide a regulated water supply for irrigation, recreation and municipal users within the basin.

An overview of the Souris River basin and the proposed control structures is shown in Figure 1. A brief summary of the Project history to date is outlined in Table 2.

Project Description

The Project components, as defined by the SBDA include:

- Rafferty Dam and Reservoir on the Souris River, 6 km northwest of Estevan;
- Rafferty-Boundary Diversion Channel;
- channelization for approximately 16 km downstream of the Rafferty Dam;
- Alameda Dam and Reservoir on Moose Mountain Creek, 4 km northwest of Oxbow.

On January 13, 1989, the governments of Canada, United States, Saskatchewan, North Dakota and Manitoba agreed to a draft operating plan for the Project and associated projects. The objectives of the draft operating plan are:

- to provide one percent (100-year) flood protection at Minot, North Dakota;
- to provide flood protection to urban and rural areas downstream from the Rafferty Dam, Alameda Dam and Lake Darling Dam;
- to ensure, to the extent possible, that the existing benefits from the supply of water in the Souris River basin and the supply of water to the Souris basin project are not compromised.

Rafferty Dam and Reservoir

The Rafferty Dam site is located on the mainstem of the Souris River 6 km northwest of Estevan (Figure 1). Facilities at the site will include a 20 m high earth-fill dam, a concrete service spillway, a low level outlet, an emergency spillway and a reservoir (Figure 2). The multi-

Table 2: Chronology of Major Events in the History of the Rafferty-Alameda Project

DATE	EVENT
1984	Planning for Project underway with the Saskatchewan Power Corporation as the Proponent.
1985	Environment Canada registered the Project with the Regional Screening and Coordinating Committee (RSCC) for review.
Feb 12/86	Announcement by the Saskatchewan government that construction of the Project would begin, pending approval of funding from the U.S. and compliance with all Canadian and provincial environmental and regulatory requirements.
	Announcement by the Saskatchewan government of approval for the Shand Thermal Generating Station.
Oct 17/86	U.S. Congress passed an Omnibus Water Bill which sanctioned a $41.1 million U.S. contribution to the Project and approved related works in the United States.
July 6/87	Environment Canada, Department of Fisheries and Oceans, and the Canadian Forestry Service reviewed a draft of Saskatchewan's Environmental Impact Statement (EIS) through the RSCC.
Sept 9-21/87	The Saskatchewan provincial Board of Inquiry held public hearings in Regina and five centres in the Souris basin.
Sept 14/87	RSCC provided comments on Saskatchewan's final EIS.
Nov-Dec/87	U.S. Army Corps of Engineers entered their draft EIS into the Public Registry and forward copies to Environment Canada.
Jan/88	Environment Canada reviewed U.S. draft EIS. City of Minot votes in favour of a tax increase to support local contributions to the Project.
Jan 7/88	Sask Water applied to Environment Canada for a licence for the Project under the International River Improvements Act.
Jan 27/88	Board of Inquiry Report was delivered to Saskatchewan's Minister of Environment and Public Safety.
Feb 15/88	Final approval for the Project was given by Saskatchewan's Minister of Environment and Public Safety.

Table 2: (Continued)

DATE	EVENT
Feb 16/88	Final approval for the Shand Thermal Generating Station was given by Saskatchewan's Minister of the Environment and Public Safety.
Mar 29/88	Preliminary construction work and site preparation for the Rafferty Dam began.
June 17/88	The licence, under the IRIA, was granted by the Minister of the Environment. Conditions were attached which would satisfy matters of federal responsibility.
July 22/88	U.S. Army Corps of Engineers released its "General Plan Report and Final Environmental Impact Statement" for the Project.
Jan 13/89	Negotiations concluded on the Canada - U.S. Agreement for water supply and flood control in the Souris River basin.
Jan 19/89	The Canadian Wildlife Federation, G. Geske and J. Dolecki filed an Application in Federal Court requesting that the IRIA licence be set aside and the federal Minister of the Environment comply with the EARP Guidelines Order.
Apr 10/89	The Federal Court of Canada quashed the IRIA licence and ordered compliance with the 1984 EARP Guidelines Order in considering a federal application for a licence under the IRIA for the Project.
Apr 12/89	The federal Minister of the Environment directed Environment Canada to apply the EARP to those areas of federal responsbility relating to the Project. The Minister also required public review as part of the process.

purpose reservoir would provide flood protection, cooling water for the Shand Thermal Generating Station, and water for irrigation, recreation and municipal users. At full supply level (FSL) the reservoir would have an elevation of 550.5 m. It would be 57 km long and have a surface area of 4900 ha. An initial operating level 1 m below FSL has been proposed for the first 20-25 years to permit recovery of oil reserves located in the upper portion of the reservoir.

Dam construction methods would follow industry standards: compacted glacial till, derived mainly from the emergency spillway, would be used for the impervious section of the dam. Because of the low strength of the clays, berms would be placed both upstream and downstream in the foundation. Wick drains would be placed under the dam fill to relieve foundation pressure. A rock face would be constructed on the upstream side to protect the dam from wave action. Topsoil would be stripped from most construction areas and stockpiled for later use. However, the topsoil would not be removed from the emergency spillway because of the abundance of surface rocks in this area. If fuel storage was required on site, then containment dikes would be constructed.

To date, coffer dams have been constructed around the main dam fill area and the low level outlet pipe area (although a gap has been left to allow passage of spring runoff), 250 000 m^3 of fill has been placed on the main dam, the wick drains are installed, the outlet structure of the low level outlet structure is complete, and work has been initiated on the inlet structure.

Rafferty - Boundary Diversion Channel

An 8.2 km diversion channel from Boundary Reservoir to Rafferty Reservoir would be constructed to permit joint operation of the two reservoirs (Figure 2). The natural slope is from Boundary to Rafferty, but when necessary, water would be pumped from Rafferty to Boundary in order to maintain water levels in Boundary. Concrete inlet and outlet structures, a gated control structure and a pump station would be built. These structures would be designed to maintain a sufficient depth of water to prevent erosion of the channel bottom when water is pumped from Rafferty to Boundary reservoir. Material excavated from the channel would be used as fill for a section of the road connecting Highways 18 and 39 across the dam. The channel is designed for a maximum flow capacity of 60 m^3/s. The channel would cross an area disturbed by strip mining.

Joint operation of these reservoirs would assist Saskatchewan in meeting downstream demands, international flow commitments, demand for cooling water from the Shand Thermal Generating Station, and projected demand for irrigation use. Connecting the two reservoirs would also allow Rafferty storage to maintain water levels at Boundary and permit the transfer of flood waters from Boundary to Rafferty.

Downstream Channelization

Channel modifications downstream from the Rafferty Dam are proposed to accommodate flow releases for irrigation, recreation and flood control (Figure 2). These would continue for approximately 16 km downstream of the dam site to the Shand Thermal Generating Station. Channelization would be accomplished by excavation, bottom dredging and straightening.

Alameda Dam and Reservoir

The Alameda Dam site is located on Moose Mountain Creek 4 km northwest of Oxbow (Figure 1). It is designed as a multi-purpose facility that would provide flood control as well as water for downstream apportionment, irrigation and recreation. It is designed as a 40 m high earth-fill dam with a concrete service spillway, an emergency spillway and a reservoir (Figure 3). Originally it was designed to have a low level outlet but, an agreement between the SBDA and Minot, North Dakota resulted in the addition of a high level outlet that would improve water quality in the Souris River. At a full supply level of 562 m the reservoir would extend 22.75 km upstream and cover an area of 1240 ha.

Site specific environmental impacts for the Alameda dam are not available since the dam site was moved after completion of the Saskatchewan EIS (1987). However, from a federal point of view, the regional and national impacts would not be significantly different from those identified for the original site location.

Water Use

Runoff characteristics are modified by changes in landuse, water consumption, and the development of control structures on waterways. In the Souris River basin, the natural flow regime has been altered by wetland drainage and the construction of water control structures on the Souris River and its tributaries. Water use in the basin includes consumptive uses such as municipal water supply, industrial and agricultural use, reservoir evaporation and thermal power cooling, and non-consumptive uses such as water-based recreation, aquatic wildlife requirements (waterfowl, fish and aquatic organisms), and aesthetic values.

Saskatchewan: Canada's water apportionment commitment under the 1959 Interim Measures to pass 50 percent of the natural flow of the Souris River to North Dakota (as measured at the international boundary) constitutes the most significant water demand in the Saskatchewan portion of the Souris River basin.

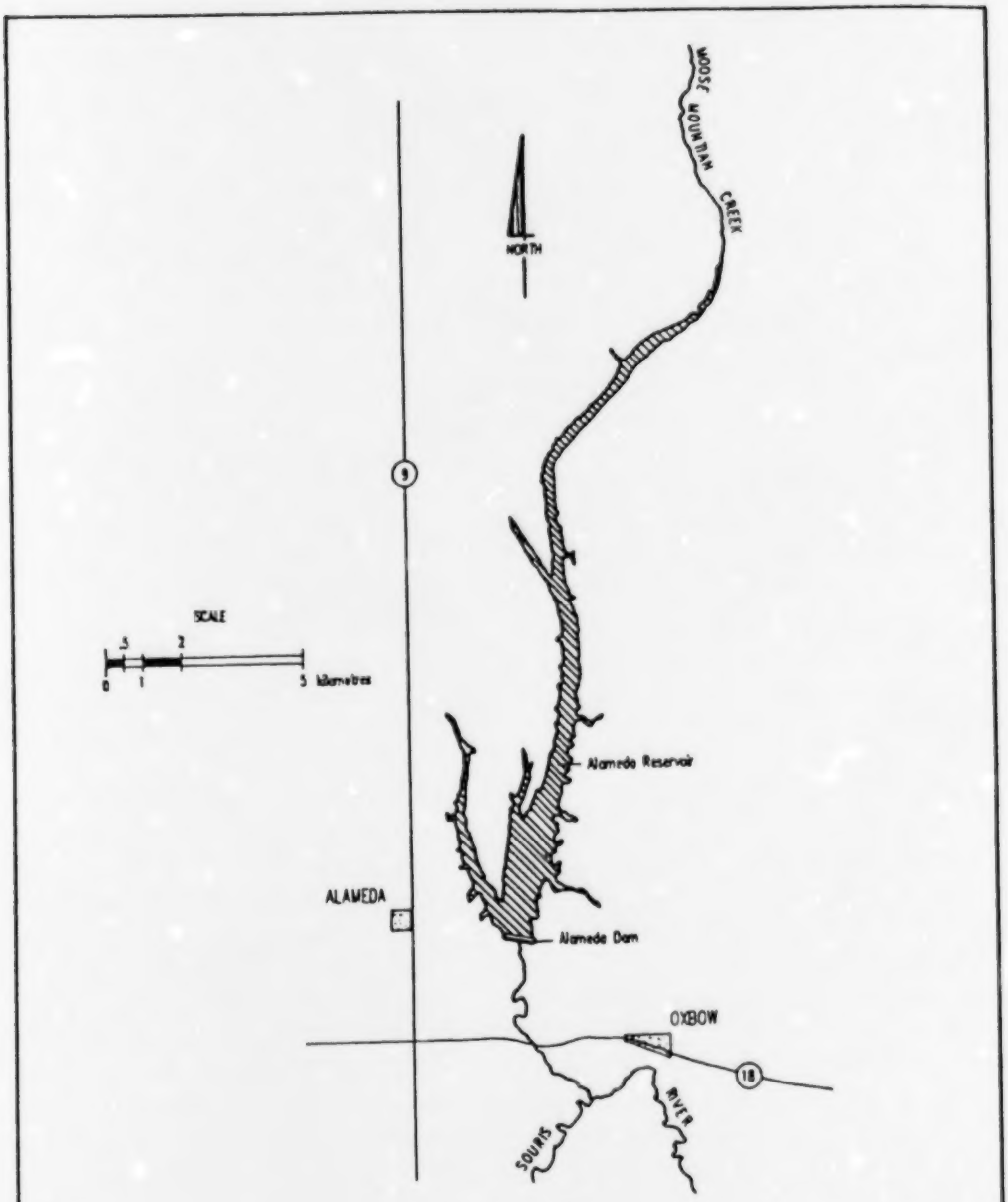
In Saskatchewan, the licensed total annual diversion from the remaining volume is 23 498 dam^3/year. Table 3 presents the licensed water uses in 1985. Surface water is the major source of supply for the communities of Estevan, Weyburn, Radville, Midale and a few smaller communities. Most small communities rely on ground water from small local aquifers.

Municipal water demand varies from month to month, with higher demands during the summer. Weyburn and Estevan are the largest municipal water users in the Saskatchewan portion of the basin. Weyburn draws its water from Nickle Lake, and since 1985, Estevan has piped its water from Boundary Reservoir. A uniformly increasing trend of 44 dam^3/year in total annual water demand has been observed for the city of Estevan.

In the Moose Mountain Creek sub-basin, municipal users are the town of Arcola, the regional municipality of Golden West and the villages of Creelman and Montmartre. However, the largest single water user is Moose Mountain Lake, which was constructed for irrigation and stock watering purposes.

The major industrial demand in the Souris River basin in Saskatchewan is the Boundary Dam Power Station which uses 9000 dam^3 annually.

North Dakota. In North Dakota, water rights are established by priority in time (ie. the user with the earliest dated right has priority). The major



Environment Canada / Environnement Canada
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Rafferty - Alameda Project Initial Environmental Evaluation

Figure 3: The Alameda Dam and Reservoir.

Table 3: Summary of Licensed Saskatchewan Water Uses - 1985 (dam^3) Located in the Effective Drainage Area Souris River Basin

	Location				
Purpose of Use	a.	b.	c.	d.	e.
Domestic	75	695	287	234	174
Municipal	3207	84	2378	850	1690
Industrial	-	-	9000**	-	240
Irrigation*	345	1248	523	449	879
Other	-	4	64	1718	40
Multi-Purposes	-	1162	-	1172	-
TOTAL	3627	3193	12252	4423	3023

a. Souris River, Above Weyburn Dam.
b. Souris River, Weyburn Dam to Rafferty Dam site.
c. Long Creek Sub-basin.
d. Moose Mountain Creek Sub-basin.
e. Souris River, Rafferty Dam site to U.S. Border.

* Represents irrigation of an estimated 1500 ha.

** The estimated uses are 6500 dam^3 for forced evaporation and 2500 dam^3 for natural evaporation. The licensed allocation is 3562 dam^3.

Source: Sask Water licensing information

licensed users are the Eaton Irrigation Project, the national wildlife refuges, and the city of Minot. The city of Minot uses its allotment for domestic purposes as much as possible.

Manitoba: The town of Souris is the only major community in Manitoba that uses water from the mainstem of the Souris for municipal supply (approximately 270 dam^3 per year). Irrigation consumption is estimated to be approximately 800 dam^3 in the Manitoba portion of the Basin. Non-consumptive water demands include aquatic wildlife, water-based recreation, and the aesthetic value of the riverine setting. Significant unlicenced water use also occurs in Manitoba.

Associated Projects

The projects described below are associated with the Rafferty-Alameda Project. Impacts arising from these projects are mentioned but are not assessed in the IEE.

Shand Thermal Generating Station: The Saskatchewan Power Corporation is constructing a 600 megawatt (MW) thermal power plant approximately 10 km southeast of Estevan. This plant is designed to help meet a projected 800 MW demand for power within the province by 1991.

The two 300 MW steam turbines will be wet cooled. Cooling water would be supplied from the Rafferty Reservoir, the Estevan sewage lagoons and coal mine dewatering operations. The projected demand for cooling water is 6400 dam^3 with 4640 dam^3 to be supplied by the Rafferty Reservoir. Cooling water would be piped along the floor of the Souris River valley from the reservoir via the Estevan sewage lagoons to the power plant.

The wastewater system designed for the power plant is a "zero discharge" system which means that water will not be discharged into the Souris River. The plant site will be contoured to ensure external drainage will be diverted and internal drainage will be collected and treated.

Boundary Dam: Construction of the Boundary Dam Power Station began in 1956 and was completed in 1959. Water from Long Creek is impounded behind the dam and is utilized as cooling water by the power station. The dam is 23 m high and 305 m long, impounding a reservoir with a maximum flood level storage of 61 500 dam^3, at an elevation of 560.8 m. Since its construction, the power plant has undergone three expansions. At the present time it produces 833 MW.

Although the reservoir was developed for the purpose of supplying cooling water to the power station, it also provides recreation opportunities for the local population. Approximately 50 cottages and permanent residences have been developed on leased land along the eastern and southern shores of the reservoir. A recreation site is located on the east side with facilities for swimming, boating, and picnicking.

Irrigation Development: The SBDA has estimated that maximum irrigation development for the Project would be in the order of 4800 ha and would occur primarily in two areas: in the valley lowlands between Rafferty Reservoir and the international boundary (3200 ha) and on uplands adjacent to Alameda Reservoir (1600 ha).

Water supply studies to determine the quantity of water which would be available for irrigation were conducted by the SBDA. These studies considered several combinations of supply alter-

natives: Rafferty Reservoir, Alameda Reservoir, the diversion channel between Rafferty and Boundary reservoirs, and ground water from aquifers. The results are shown in Table 4.

Recreation/Tourism Facilities: Rafferty and Alameda reservoirs are intended to provide water-based recreation in southeastern Saskatchewan. Three recreation areas would be developed in association with the Project. Rafferty Park would occupy the eastern end of Rafferty Reservoir, a park has been proposed for the southeast side of the Alameda Reservoir, and Dr. Mainprize Regional Park, which would be inundated by Rafferty Reservoir, would be relocated. A new site for this park has been tentatively identified approximately five km northwest of the present location. The Lutheran Bible Camp, located south of Halbrite, would also be inundated, and a new site must still be chosen.

The development of cottages at the various sites is proposed by the SBDA. Lower Rafferty Park is expected to accommodate 125 cottages, with 50 more adjacent to the relocated Dr. Mainprize Regional Park. One hundred cottages are planned for Alameda Reservoir.

The development of recreation facilities associated with the reservoirs would necessitate the formulation of park master plans and landuse controls. These plans would have to be integrated with water management plans and reservoir operating plans.

Flood Control: In North Dakota, a number of developments are proposed to operate in conjunction with the Project to provide flood protection to the State. The following projects would be undertaken:

- modification of the existing gated outlet on Lake Darling Dam;
- improvements to control structures in the Upper Souris NWR;
- improvements to the control structures at the J. Clark Salyer NWR, including upgrading and raising three dams and adding a low flow structure on another dam; and
- the construction of urban levees at selected sites along the Souris River channel in North Dakota.

POTENTIAL IMPACTS OF THE RAFFERTY - ALAMEDA PROJECT

The following sections summarize the essential findings of the IEE. These findings are presented for each area of federal responsibility under four general headings:

- project impacts - scientific assessments of the likely effects of the Project on the Souris River Basin, based on knowledge of existing conditions, the Project's plans for construction and operation, and anticipated responses within the ecosystem;
- mitigation - those measures that can be applied to offset undesirable impacts;
- residual impacts - those impacts that cannot be mitigated; and

Table 4: Proposed Level of Saskatchewan Irrigation Development

	Upland	Lowland
Total Development	1600 ha	3200 ha
Water Supply Source	Alameda 1600 ha	Alameda 1200 ha Rafferty 2000 ha
Water Demand	Alameda 7200 dam^3	Alameda 3600 dam^3 Rafferty 6000 dam^3

Source: Rafferty-Alameda Project
EIS, Chapter 13 - Irrigation

- information deficiencies - areas for which further information should be acquired or supplied by the proponent before the effects in a particular area can be assessed.

Impacts deemed to be "significant" or "moderate" are presented in Table 9. Table 10 summarizies information deficiencies. These tables are located in the Summary Remarks section at the end of this report.

Water Quantity

There are two broad aspects to concerns about water quantity:

- continued compliance by Saskatchewan and North Dakota with the flow volume requirements of the 1959 Interim Measures, and

- impacts arising from changes in current flow patterns and the water level expectations of downstream users.

The following section describes the most direct effects of the Project - changes in stream flow and water levels. In prairie rivers, water quality is closely linked to flow volumes, and volumes affect use of aquatic and floodplain habitat by fish and wildlife. These related aspects (water quality, fish and fish habitat, and use by migratory birds) are described in separate sections.

Project Impacts

Saskatchewan: In Saskatchewan, the Project would have both positive and negative effects on water availability. Existing Canada/U.S. arrangements allow Saskatchewan to retain 50 percent of the natural flow of the Souris River. However, since 1959, the total volume of water passed to the United States, by Saskatchewan, is equal to 101 percent of the total natural flow in the Souris River at Sherwood, North Dakota. The Project represents the construction of reservoir capacity that would enable Saskatchewan to retain the quantity of Souris River water to which it is entitled.

The reservoirs are projected to take between 7 to 43 years to fill, depending on annual precipitation. When full, the reservoirs would flood 6140 ha of farmland, wildlife habitat and floodplain. Storage of water in the reservoirs would increase the area's drought-proofing capability and regulate the extremely variable flows in the river. The reservoirs would reduce flood peaks while prolonging the duration of post-flood flows. Summer flows would be greater than at present, and higher than normal flows may occur prior to flood events and when stored water is released.

Hydrologic impacts of the Project were analyzed using a computer water balance model. Under the 50/50 scenario, 54 to 66 percent of the total historical flow would be delivered to North Dakota. Under the 60/40 scenario, flows passed to North Dakota were reduced by 4 percent from the 50/50 scenario.

Evaporation from the reservoirs would reduce the volume of water passed down the Souris. Under certain conditions, in high flow years, proposed revisions to the 1959 Interim Measures would permit Saskatchewan to retain 60 percent, rather than 50, of the natural flow as an "evaporation credit".

North Dakota: In North Dakota, the flood hazard to communities along the Souris would be reduced, particularly at Minot. The total flow of water into North Dakota would be reduced from that historically received. Lake Darling would experience the most severe impacts as its waters would be drawn down to provide critical flow to the wildlife refuges during low flow conditions. Low water conditions in the reservoir would occur more frequently. In general, the reservoir would be lower prior to spring flood and would take

longer to refill. It is the forecast runoff and the level of Lake Darling that determine whether Saskatchewan must pass 50 or 60 percent of the flow of the Souris River to North Dakota. If on October 1, the level of Lake Darling is below 485.24 m, Saskatchewan must pass 50 percent of the flow to North Dakota in the following calendar year. If the level on October 1 is above 485.24 m, Saskatchewan could retain 60 percent if the flow accumulated to September 30 is greater than 24 700 dam^3.

Under a Project modelling scenario where 50 percent of the natural flow was passed to North Dakota, zero flow conditions in the Souris River would occur less frequently and the frequency of low flow conditions would remain about the same. Changes in levels in Lake Darling cause water quality concerns, which are discussed in more detail in the Water Quality section.

Manitoba: In Manitoba, the upstream reservoirs and associated water uses would reduce the amount of water entering the province from that received historically. The 1959 Interim Measures require North Dakota to pass 0.566 m^3/s to Manitoba from June to October inclusive. Currently Manitoba receives more than the required maximum for this period. Flows in other months are often zero. Modelling scenarios predict that, with the Project, the frequency of zero flow conditions at Westhope would decrease from 13 percent to about 12 percent. In periods of 'severe drought', as defined by an aggregate volume of storage in the refuges of less than 66 600 dam^3, North Dakota is not obligated to pass 0.566 m^3/s and can pass a lower flow. Under simulated Project conditions, Manitoba determined that the 'severe drought' criteria would be applied in seven years as compared to five years under simulated historical conditions for the period 1931 to 1961.

Mitigative Measures

Mitigative measures require the development of a detailed basin operating plan that would include flood forecasting to optimize water management benefits in all jurisdictions.

Residual Impacts

The reduction of flows to North Dakota and Manitoba cannot be avoided if the reservoirs are constructed and operated as set out by the SBDA.

Information Deficiencies

The predictions of impacts on flow volumes and flood levels were developed from computer simulations using data sets for a variety of time periods and different areas of the basin. The predictions are considered accurate, but a better overall picture of water flow through the whole basin system and the impacts of different filling scenarios would be achieved if a common updated data set were available.

Water Quality

At present, water quality in the Souris basin is extremely variable, a common situation in prairie rivers under semi-arid climatic conditions and extensive agricultural development. Quality varies through the year with flow levels and also varies between the mainstem Souris, its tributaries, and the existing reservoirs.

In general, the effects of the Project would be to moderate these differences in water quality

between the components of the Souris system. The tributaries of the Souris, particularly the Des Lacs River and Moose Mountain Creek, would continue to have the highest water quality in the basin. The Rafferty Reservoir would have poor water quality at times, but water quality in the mainstem Souris would likely improve, particularly during low flow periods.

Governing all of these anticipated changes, are Canada/U.S. obligations under the Boundary Waters Treaty which state:

"boundary waters ... shall not be polluted on either side to the injury of health or property on the other."

The assessment of water quality impacts is an extremely complex and technical area. The ultimate effects of the Project on water quality depend on the way in which the Project components are operated, the filling period of the reservoirs, and also on outside sources of pollution, such as municipal sewage discharges, industrial discharges, run-off from agricultural land, and downstream bacterial input from the wildlife refuges. Water quality was evaluated in relation to the Project in terms of total dissolved solids, dissolved oxygen and free ammonia, pH, metals, nitrogen, phosphorus, sodium, sulphate, chloride, bacterial concentrations, and pesticide residues. The complexity of the system makes absolute predictions about water quality difficult. However, it offers a variety of opportunities for mitigation and ways in which overall water quality can be improved through operating methods, timed releases of sewage effluent, agricultural practices, and water allocation.

Project Impacts

Saskatchewan: In Saskatchewan, water quality in the Souris River would be altered by the change in hydrologic regime. As a result of regulated flows water quality in the river should improve. Aquatic habitat should be improved because of increased spring and summer flows. Control of stream flow would also moderate the extremes in water quality experienced on the river and may produce a more stable aquatic biological community between the reservoirs and Lake Darling. However, relatively poor quality water would be released from Rafferty Reservoir which would affect downstream water quality. Modelling of worst case scenarios indicate that water quality between the dam and the international boundary could deteriorate in terms of increased free ammonia concentrations and low dissolved oxygen. Impoundments and weirs built to control irrigation water may provide opportunities for greater aeration of the water as well as overwintering habitat for fish. Construction activities associated with the dam and channelization below Rafferty Reservoir would increase turbidity in the short-term. The reservoirs would trap sediment and reduce sediment load in the channels downstream, probably as far as Lake Darling.

During the filling period, water in the new reservoirs would undergo rapid changes in quality. The soil in the flooded areas would release nutrients through the microbial and chemical decay of organic material and would also release salts, minerals, and some metals by solution. The mercury content of the topsoil and subsoil in the area of the Rafferty Reservoir is slightly higher than the regional norm. Naturally occurring mercury would be released from soil by chemical reaction under reducing conditions and would be incorporated into the food chain. This process is called mercury methylation and would proceed until the organic soils or vegetation were completely decomposed. As a result of this process, mercury levels in fish would increase. Within 10-20 years, mercury levels should decline and stabilize. The sediments deposited in the reservoirs may also release elements and nutrients.

Water quality in the Alameda Reservoir would be better than that in Rafferty, largely because of basin characteristics, shorter residence times, and greater depth of the water. Alameda water would be used for irrigation, municipal uses, and down-

stream apportionment, specifically to dilute Rafferty water and improve water quality at the international boundary.

Rafferty Reservoir would be shallow (15 m maximum), and water would be contained in the reservoir for a considerable period. Evaporation would concentrate dissolved substances, decreasing water quality. If ground water augmentation of the reservoir occurs, Rafferty water may not meet irrigation standards for sensitive crops with regard to total dissolved solids, and boron. In the long term, the water would be suitable for municipal water supply and most agricultural uses. The warm, shallow reservoir waters with their high nitrogen and phosphorus concentrations may promote algal blooms in mid to late summer in some years. Die-off of the algae and subsequent decomposition would deplete oxygen levels in the reservoir and may lead to summer fish kills, particularly during periods of hot, calm weather. Rafferty water may require dilution with higher quality waters from Alameda in order to meet international water quality obligations.

The suitability of the reservoirs for fish depends in part on dissolved oxygen content over the winter period. Winter fish kills result when dissolved oxygen becomes depleted. It is predicted that winter fish kills would be an infrequent problem in Alameda Reservoir, and a viable sport fishery could probably be maintained. Steady water releases from Alameda could allow a fishery to be maintained downstream in Saskatchewan.

Anoxic (low dissolved oxygen) conditions would occur in Rafferty Reservoir, and fish kills would be common, particularly in late summer and early fall and in low water years. If anoxic water was released from Rafferty for pre-flood drawdown in late winter and early spring, aquatic life for tens of kilometres downstream could be adversely affected. These effects may extend to North Dakota under worst case conditions.

Extreme flood events (e.g. 1 in 100 year flood) would replenish the reservoirs with higher quality water that would be retained within the system for several years.

North Dakota: In North Dakota, water quality at the border would be improved in wet years by increased flows in the normally dry July to December period. Discharges from Rafferty to augment flow in the Souris River would have to be mixed with better quality Alameda water in a ratio of up to 2 parts Alameda to 1 part Rafferty to minimize effects at the international boundary. As most water crossing the border would be from the Alameda Reservoir, overall water quality in the river would improve in most years. In years when significant spring floods are expected, sufficient water may not be available to dilute pre-flood drawdown from Rafferty adequately, and water quality would be impaired. This water would adversely affect aquatic life below Rafferty, but the effects would extend past the Saskatchewan-North Dakota boundary in a worst case scenario only.

Lake Darling would benefit from the trapping efficiency of the upstream reservoirs as inflowing water would carry reduced sediment and nutrient loads. It is the reduced **volume** of water reaching Lake Darling with resulting lower lake levels that causes increased concern for water quality in the lake. Water quality would be affected most when water yields from the upper basin are low and during winter nearly every year. The magnitude of spring inflow would be reduced, altering the annual flushing pattern that has prevailed in the lake. The Lake Darling fishery would be adversely affected.

Lake Darling would absorb the direct effects of the upstream reservoirs. Downstream water quality between Lake Darling and the Manitoba border would depend on how the changed flow regime affects the river's capacity to assimilate

pollution inputs, such as sewage discharges and increased nutrient loads from the wildlife refuges. Lower water levels in the refuges would result in higher nutrient and bacterial concentrations in downstream water especially during spring and fall waterfowl migration periods.

Manitoba: The Manitoba border is 660 km downstream of the reservoirs, and the effects of the Project on water quality would be attenuated by physical and chemical processes in the river and refuges. The most significant effects in Manitoba would result from water management works and plans undertaken by North Dakota to offset the decrease in water volumes available to users in the state. On average Manitoba would receive about 80 percent of the water it has received historically. The frequency of very low flow or no flow conditions would increase, and average annual flows would be reduced. Water quality effects would depend on flow. Basically any time that higher than present 'normal' flows occurred, quality would be improved; when lower than 'normal' flows occurred, quality would be impaired.

Most concerns about quality would occur during dry periods, when the U.S. would be passing only the amount of water required by the Interim Measures. Releases of high nutrient water from the wildlife refuges would aggravate already serious algae growth problems in quiet reaches of the river, affecting recreational values, further reducing dissolved oxygen concentrations and possibly increasing the frequency of fish kills. Currently, at some times of the year, waters at the boundary do not meet Manitoba free ammonia objectives for protection of aquatic life, and the incidence of non-compliance may increase. With reduced volumes, the river may not be able to assimilate sewage discharges from towns along the river.

Mitigation Measures

Saskatchewan: Proposed mitigation measures for water quality impacts in Saskatchewan are related to operating plans and controls that optimize releases of water and encourage sound water management practices to minimize pollution from external sources. A basin-wide water management plan would involve establishing transboundary water quality objectives and monitoring water quality carefully so that appropriate decisions and flow adjustments can be made to ensure compliance with Canada's obligations under the Boundary Waters Treaty. This plan would allow advance notice to be given to downstream users in North Dakota and Manitoba so that appropriate actions could be taken in their jurisdictions. This is particularly important with regard to releases from Rafferty Reservoir. Multi-level outlets should be built for both reservoirs to provide better control over quality of water released. Artificial riffle areas and irrigation weirs should be used to maximum advantage to enhance oxygenation of the water, particularly during recovery from anoxic conditions.

North Dakota: Mitigative measures proposed by North Dakota relate mostly to its desire for Canada to formalize water quality objectives, operating procedures and monitoring requirements in the Project's operating plans and licences and to enter into joint agreements on transboundary water quality objectives prior to Project approval. The city of Minot may have to upgrade its sewage treatment facilities. Basin-wide operational plans could be developed for management of water levels in the reservoirs and wildlife refuges to offset some of the anticipated adverse effects of water quantity and quality changes. Some alternatives may ameliorate water quality concerns in Manitoba, and these should be modelled and investigated.

Manitoba: Predictions of water quality effects in Manitoba are somewhat uncertain, and it is suggested that the jurisdictions cooperatively undertake and maintain a monitoring program to evaluate the impacts, trends in water quality, and compliance of the United States with water quality objectives. A comprehensive multi-jurisdictional water management plan for the entire Souris River basin is proposed as a means of securing sustainable water use in the basin. This should complement international agreements on water quality objectives.

To maintain adequate water quality, it may be necessary for the four municipalities that discharge sewage to the Souris River to time effluent discharges and possibly enlarge lagoon capacity to store waste through extended drought periods.

Residual Impacts

Over a period of several decades, total dissolved solids in Rafferty Reservoir would gradually increase as would the reservoir's trophic status. Lake Darling would continue to undergo a natural long-term eutrophication process that can only be retarded, not prevented. The process may be accelerated by lower water levels and reduced spring flushing, but this may be partially offset by reduced nutrient and sediment loading and better quality input from the Souris River. The Manitoba reaches of the Souris River would experience an increase in dissolved constituents, over time, as a result of increased evaporation in North Dakota and Saskatchewan.

Information Deficiencies

Transboundary water quality objectives should be developed immediately. Objectives should be established for those parameters most likely to be affected by the Project, including dissolved oxygen, ammonia, total dissolved solids, sulphates, chlorides, and boron.

Water quality impacts in the Manitoba stretches of the river will largely depend on how the refuges are operated. A precise operating plan for the refuges should be presented to all agencies concerned so that an accurate assessment of water quality implications can be made.

The modelling scenarios developed in the SBDA EIS and by the US Army Corps of Engineers do not adequately address the collective impacts of the project on Manitoba. Modelling must be applied to the remainder of the basin and the results made available to all jurisdictions.

No information has been provided on how the aquatic ecosystem of the river will respond to the changed flow regime and specifically to modified operation of the refuges. Spring flushing is an important element in the aquatic ecology of prairie rivers. The Project would reduce spring flow by as much as 50 percent and no attempt has been made to assess the impact of this change on the aquatic ecosystem.

Water quality models used by the Proponent should be calibrated to the Souris River basin and verified.

The Proponent's intent concerning ground water pumping into the reservoirs requires clarification. An expanded data base for Moose Mountain Creek would more accurately represent normal hydrologic conditions.

More definitive information is required on the water quality impact of irrigation development as it may affect transboundary waters.

Migratory Birds and Their Habitat

Canada is responsible for protection of migratory birds and their habitat under the Migratory Birds Convention Act. While the Act covers many

species, habitat in the Souris River basin in southeastern Saskatchewan and North Dakota is used intensively by waterfowl.

Across North America, duck populations have declined substantially in the last two decades. Canada is a signatory to the North American Waterfowl Management Plan (NAWMP), through which Canada and the United States have agreed to work jointly to restore waterfowl populations to the levels of the 1970s through habitat restoration. Restoration of prairie pothole breeding habitat for mallards and pintails has been chosen as the top priority under this program.

The Moose Mountain Uplands, in the Moose Mountain Creek basin, is one of seven areas identified under the NAWMP as prime waterfowl breeding habitat in southern Saskatchewan. The following statements, made in the NAWMP document and quoted in the IEE, describe important principles of the NAWMP that apply to the Project.

"Reversing or modifying activities that destroy or degrade waterfowl habitat is imperative to the future success of waterfowl management... all other efforts would be in vain if the ongoing trend of habitat loss and degradation is not reserved."

"The maintenance of abundant waterfowl populations is dependent on the protection, restoration and management of habitat. The persistent loss of waterfowl habitat should be reversed."

"Local government and public land management agencies should be encouraged to zone or otherwise regulate land uses to prevent the destruction or degradation of waterfowl habitat."

"Public works projects planning should include the prevention or mitigation of destruction or degradation of waterfowl habitats."

Canada and the United States view waterfowl as an international resource, and any impact on waterfowl production in one country would be felt in the other.

The riverine habitat along the Souris River and Moose Mountain Creek is rated by the Canada Land Inventory (CLI) as Class 2 or Class 3 waterfowl habitat, having only very slight or slight limitations to waterfowl production. The Rafferty Reservoir would flood 57 km of riverine habitat along the Souris, and the Alameda Reservoir would flood 24 km of riverine habitat along Moose Mountain Creek.

The Upper Souris and J. Clark Salyer national wildlife refuges are the most valuable waterfowl habitat along the Souris River, and J. Clark Salyer NWR is considered to be one of the most productive refuges in the United States. Reduced downstream flows associated with the Project would detrimentally affect use of these refuges by waterfowl.

Although the Manitoba portion of the Souris is rated by the CLI as either class 3 or 4, generally, it is not considered to be very important for the production of waterfowl. However, knowledge of its present productivity is incomplete.

Project Impacts

Saskatchewan: In Saskatchewan, riverine habitat along the Souris River and Moose Mountain Creek would be inundated by the Rafferty and Alameda reservoirs, and waterfowl production from these areas would be lost. Habitat productivity would be adversely affected along the Souris River downstream of Rafferty where channel modifications would be made. If the Project indirectly encourages drainage of adjacent wetlands for agricultural development, additional habitat and production would be lost.

Waterfowl populations may suffer increased hunting mortality during fall staging as waterfowl that would normally stage over a large area would tend to concentrate in and around the Rafferty and Alameda reservoirs, and hunter success would increase. The new reservoirs are not

expected to provide substantial areas of shoreline breeding habitat. The shorelines would be subject to wave, wind, and ice action and would be actively eroding for many years, limiting the development of aquatic vegetation necessary for brood rearing along much of the reservoir shoreline. Some areas of valuable habitat may develop in the upstream ends of flooded coulees and tributaries.

The net impact on Saskatchewan waterfowl populations, with no mitigation considered, is estimated to be an annual loss of about 4300 birds. This would be a significant loss, representing 9 percent of the number of breeding mallards expected to be produced annually from the Moose Mountain Uplands key program area through the NAWMP.

North Dakota: Lower water levels in the two wildlife refuges would significantly affect management of these areas and, in the most severe low water years, may reduce migratory bird habitat by 65-95 percent and productivity by an average of 80 percent. Lower levels would accelerate the growth of noxious weeds, and incidences of avian botulism are expected to double. Worst case reductions in productivity, with no mitigation, are estimated to be almost 22 000 ducks annually, not including increased botulism mortality. A proportion of the birds produced in the United States move into Canada before fall migration and/or return to Canada to breed in subsequent years. It is estimated that the indirect worst case losses to Canada could amount to 4400 ducks annually. Reduced opportunities for waterfowl hunting are expected as a result of short-stopping of waterfowl at the Rafferty and Alameda reservoirs.

Internationally: In an international context, the total losses are substantial and significant and, if not fully mitigated, would seriously jeopardize the success and credibility of the NAWMP in the prairie pothole region of the continent.

Manitoba: The Manitoba reaches of the Souris River are not considered to be important waterfowl breeding habitat, and project-related losses are not expected to be significant. Further information is required in order to substantiate this expectation.

Mitigative Measures

In the spirit and intent of the NAWMP, all waterfowl habitat losses associated with the Project must be fully mitigated on an in-kind and acre-for-acre basis so that "no net loss" of waterfowl production would result. This is possible in theory, but actual success would depend on the commitment of all participating agencies.

Residual Impacts

No residual impacts would result if losses of waterfowl habitat and productivity are fully mitigated.

Information Deficiencies

Comprehensive mitigation and monitoring plans would have to be in place if the Project proceeds. These plans must contain:

- a description of the land parcels to be acquired for mitigation purposes;

- a description of the habitat management techniques be employed to convert each land parcel into productive waterfowl habitat;

- an account of the waterfowl production expected from the mitigation lands in relation to the predicted waterfowl production losses;

- a description of the population monitoring studies that would be conducted in order to determine the degree to which complete mitigation was achieved;

- a description of the land-use monitoring program that would be implemented in order to confirm that further drainage of off-river wetlands was not occurring; and

- a description of the restrictions that would be placed on waterfowl harvest from areas adjacent to the reservoirs, and the compliance monitoring program that would be implemented, in order to ensure that increased harvesting was not occurring.

Before the Project could proceed, data would have to be collected on the distribution of riparian and upland waterfowl habitat types, and on the size and composition of the resident breeding waterfowl population, along the Souris River in Manitoba. These data are required in order to substantiate the expectation that the Project would not adversely affect waterfowl along the Souris in Manitoba.

Fish and Fish Habitat

The Department of Fisheries and Oceans administers the Fisheries Act and has responsibility for the protection of fish and fish habitat from disruptive and destructive activities. The long term objective of the department is to increase the productive capacity of fish habitat, and an important aspect of that objective is application of a policy of 'no net loss' of habitat or productivity. This policy deems any loss of habitat to be significant and seeks to balance unavoidable habitat losses with equal habitat replacement on a project-by-project basis. This can be achieved through active conservation of currently productive habitat, the restoration of damaged habitat, and the development of new habitat.

Existing Fisheries Resources

Throughout the Souris River basin, existing water control works, dams and weirs limit the movement of fish through the river system. Interchanges between reaches can often occur only under very high water conditions and may result in fish being stranded in areas that cannot support them in the long term. In Saskatchewan, the Souris mainstem was divided into five of these artificially bounded reaches for assessment of fisheries resources. Moose Mountain Creek was divided into three reaches. The species present in each of these areas are summarized in Tables 5 and 6. Northern pike and yellow perch are the most abundant game fish in the basin.

In general, the upstream reaches of the mainstem support naturally reproducing populations of the primary sport fish species - yellow perch and northern pike. Walleye are stocked in Nickle Lake and Dead Lake in reaches 1 and 2. Sport fish spawning occurs in these reaches, and they are popular for recreational fishing in summer. Reach 2 would be flooded by Rafferty Reservoir.

The lower reaches support few sport fish but have a greater habitat and species diversity. Reach 5, from Oxbow Creek to the international boundary, supports the greatest species diversity. The area provides rearing and overwintering habitat for yellow perch and northern pike, but spawning habitat for these species is limited.

The upper reaches of Moose Mountain Creek include the marshy springfed headwaters of the sub-basin at Moose Mountain Lake. Northern pike and yellow perch are stocked, and a large population of white suckers is also present, making the lake a popular recreational fishing

Table 5: Distribution of Fish Species Within the Souris River Mainstem Downstream of Weyburn

Species	River Reach[1]				
	1	2	3	4	5
Northern pike	+	+	+	+	+
Brassy minnow					+
Golden shiner					+
Emerald shiner				+	
River shiner					+
Common shiner	+	+	+	+	+
Sand shiner		+		+	
Fathead minnow	+	+	+	+	+
Longnose dace				+	+
Pearl dace					
White sucker	+	+	+	+	+
Black bullhead		+	+	+	+
Brown bullhead					
Tadpole madtom			+		+
Brook stickleback	+		+	+	
Ninespine stickleback					
Trout-perch	+	+	+		+
Largemouth bass					
Iowa darter					+
Johnny darter				+	+
Yellow perch	+	+	+	+	+
Blackside darter				+	+
Walleye	+	+	+	+	+

[1]Reach 1: From Weyburn down to proposed FSL.
2: From proposed FSL to proposed Rafferty Dam site.
3: From proposed Rafferty Dam site to Estevan Dam.
4: From Estevan Dam to Oxbow weir.
5: From Oxbow Weir to U.S. Border.

Table 6: Distribution of Fish Species Within Moose Mountain Creek

Species	River Reach[1]		
	1	2	3
Northern Pike		+	+
Brassy minnow			
Golden shiner			
Emerald shiner			
River shiner			
Common shiner	+		+
Sand shiner			+
Fathead minnow	+	+	+
Longnose dace			
Pearl dace	+		
White sucker	+	+	+
Black bullhead		+	+
Brown bullhead			
Tadpole madtom			
Brook stickleback	+	+	+
Ninespine stickleback	+		
Trout-perch	+		
Largemouth bass			
Iowa darter		+	+
Johnny darter	+	+	+
Yellow perch	+		
Blackside darter			+
Walleye			+

[1]Reach 1: Upper watershed.
2: Area of proposed Alameda Reservoir.
3: From proposed Alameda Dam site to confluence with Souris River.

area. Reach 2 is the area of Moose Mountain Creek that would be flooded by Alameda Reservoir. Northern pike is the only game fish reported in this reach, but little pike spawning habitat is present. Reach 3 extends 4 km from the Alameda Dam site to the confluence with the Souris mainstem. Overwintering habitat is present and walleye, northern pike, and several other species occur.

In North Dakota, lake, river and marsh habitat is provided within the Souris Basin for walleye, northern pike, yellow perch and a variety of forage species similar to those found in Saskatchewan. Lake Darling provides habitat for northern pike, walleye, and yellow perch, which all reproduce naturally in the lake. These species, as well as smallmouth bass, are also supported by stocking, and the lake is an important recreational fishery. It is, however, nutrient-rich and subject to algal bloom and winterkill because of low oxygen levels, particularly in low water years. The value of Lake Darling as a fishery would decline naturally over the years as eutrophication proceeds and the lake slowly becomes more shallow through sedimentation. Dams on the Souris River limit the upstream distribution of fish therefore, Lake Darling may be responsible, in part, for downstream fish populations.

The Souris River in North Dakota is rated as a 1-A river - the highest state classification, and is the most heavily used river fishery in the State outside of the Missouri and Red river systems. At present, flows are variable and no-flow periods are common above Lake Darling. Below Lake Darling, flows are regulated to provide water supply to the wildlife refuges. Northern pike is the most common sport fish taken, followed by walleye, yellow perch and smallmouth bass. The wildlife refuges are extremely important local sport fisheries. Important spawning habitat for northern pike and walleye occurs in the area, though winterkill is a problem in shallow impoundments and in the mainstem Souris in low flow years.

In Manitoba, the upper reaches of the Souris River have a relatively low species diversity. In contrast, the lower reaches below the town of Souris support a rich and diverse fauna. Northern pike occur throughout the basin, but walleye are limited to the lower reaches. Goldeye, mooneye, freshwater drum, carp and rock bass are all angled below Wawanesa. Carp have been found in the past above the Wawanesa Dam and in North Dakota. The best spawning habitat for walleye occurs just below Souris, but dependable northern pike and yellow perch spawning habitat is located upstream of Souris. The Manitoba reaches of the Souris River are subject to low flow levels and algal blooms and subsequent oxygen depletion. Tolerance to low oxygen levels seems to be the key factor in fish survival in these reaches and a factor limiting development of a valuable sport fishery in walleye and northern pike.

Project Impacts

Saskatchewan: Construction of the Rafferty and Alameda dams would change existing riverine fish habitat into lake habitat and under some circumstances would subject fish to degraded water quality. Fish movements would be blocked in areas where free movement was previously possible. The hydrologic regime of the Souris River downstream of the reservoirs would be altered.

Approximately 57 km of riverine habitat along the Souris River, including Dead Lake and several kilometres of the lower reaches of Roughbark Creek, would be inundated when the Rafferty Reservoir is at full supply level and replaced by lacustrine habitat. Spawning habitat for sport fish in upstream areas would be lost. All fish species currently present in the area of the reservoir are expected to do well under the new conditions, although success would depend on the operating regime of the reservoir, particularly during the egg incubation period. Channelization of the Souris

River downstream of the Rafferty Reservoir would disrupt and reduce habitat in that area.

On Moose Mountain Creek, the Alameda Reservoir would flood 24 km of riverine habitat. It is expected that this would result in an increase in usable habitat for northern pike and walleye, and conditions may be suitable for yellow perch and rainbow trout as well.

Modelling of post-project water flow conditions in the reaches below the Rafferty and Alameda dams indicates that operation of the dams would not have an adverse impact on fisheries values and may in the long term improve habitat for walleye and northern pike. However, these conclusions must be evaluated in light of changes in water quality that would also affect the populations. Effects of the proposed Rafferty-Boundary diversion channel on fish populations in both the Boundary and Rafferty reservoirs are unknown.

As a result of water quality changes, both reservoirs would be subject to increased nutrient levels and growth of aquatic plants and algae. Rafferty Reservoir would have the poorest water quality and may be subject to algal blooms in mid to late summer. Decomposition of the algae after die-off would compound other decomposition processes already underway and may result in depleted oxygen levels, possibly leading to summer fish kills, particularly during hot, calm weather. If winter water levels are low, oxygen depletion may also be a problem, resulting in winter fish kills. Walleye are more susceptible to winterkill than northern pike and yellow perch. Releases of anoxic water from Rafferty Reservoir in late winter and early spring would adversely affect fish overwintering in the reservoir and in areas downstream.

As discussed earlier, naturally occurring mercury would be released from the flooded soils by chemical processes operating in the reservoir. Mercury would tend to accumulate in the food chain, reaching its highest concentrations in the muscle tissue of predaceous fish such as northern pike. Within two or three years, the mercury content of the fish may exceed recommended standards for human consumption. This effect could continue for 10-20 years, before mercury levels decline and finally stabilize as decomposition of vegetation and organic material in the flooded soils ceases. The effects may extend to fish downstream of the dams. The mechanism for this downstream contamination is unknown, but may be linked to consumption of invertebrates.

On balance, the Project is anticipated to achieve the 'no net loss' of habitat objective in Saskatchewan, through improved habitat conditions in areas that would receive more reliable water supplies throughout the year.

North Dakota: Changes in water supply and water quality would adversely affect fisheries in North Dakota, particularly in Lake Darling. The exact nature of these impacts would depend on meteorological conditions, the operating regimes of the reservoirs, water use allocations and priorities established by the State.

Water shortages would be a major problem in North Dakota should Saskatchewan begin to retain its 50 percent share of Souris River flow. The fishery in Lake Darling would be most severely affected. Significant winter fish kills would occur if the level of Lake Darling falls below 485.24 m. Modelling analysis showed that the frequency of Lake Darling entering winter below 485.24 m would increase by about 30 percent as a result of the Project. Lake Darling was constructed in the 1930s to provide water for the Upper Souris and J. Clark Salyer national wildlife refuges. Other uses, including development of the sport fishery, have been possible only because Saskatchewan has not retained its share of Souris water. According to predictions, water shortages would occur in 75-90 years out of 100 after construction of the Project. With generally lower volumes available, it would be necessary to

draw down Lake Darling water to maintain levels in the refuges. This may result in policy decisions on water allocation that would jeopardize the Lake Darling fishery in favour of the wildlife refuges. Lower water levels, higher nutrient levels and gradual sedimentation in Lake Darling may increase the incidence of winter fish kills to about one year in five. This would reduce natural productivity and make more frequent stocking of the lake necessary. Models indicate that the combination of low lake levels and delayed spring recovery could preclude the maintenance and re-establishment of a viable fishery for periods of many consecutive years. Only during extended wet cycles could the fishery recover to present levels.

Lake Darling may also be drawn down in late winter and early spring as part of the integrated flood control program in the basin. Water would be released from Lake Darling to provide flood storage capacity during the spring runoff period.

This may contribute to the incidence of winterkills, although many other factors would also be important. Pre-flood drawdown would curtail ice fishing on the lake, a popular recreational activity, in late February and early March. Filling of the lake may also be delayed in spring until mid or late April in some years and peak elevations would be 0.3 to 0.9 m lower than at present. This could affect the spawning success of walleye, northern pike, and yellow perch, which are all early spawners.

The Project would also affect the Souris River fishery downstream of Lake Darling. Some benefits to the aquatic ecosystem would result from higher than normal flows in late summer during wet years. However, in dry or moderate years, low flows and periods of no flow are expected to increase in late summer, fall and winter in these reaches. At present, Lake Darling is the major source of fish to repopulate the lower Souris reaches following periods of low flow. If the Lake Darling fishery declines as expected, a source of fish for natural restocking of the Souris would be lost. Discharges from the Minot sewage lagoons may have a greater effect on water quality in the downstream reaches because of generally lower flows and the river's lower capacity for assimilation of pollution inputs.

North Dakota is concerned that the Project may encourage carp to migrate upstream to the J. Clark Salyer NWR. Currently, carp are believed to be confined to areas downstream of the Wawanesa Dam in Manitoba. The environment in the refuge would be ideal for carp and their presence would be detrimental to native fish populations and waterfowl as they increase the turbidity of the water and uproot and destroy aquatic vegetation. It is possible that activities associated with the Project could facilitate movement of carp past the Wawanesa Dam during a major flood. Project plans include placement of an electric carp barrier in the J. Clark Salyer NWR.

Manitoba: Manitoba would suffer decreased flows and changes in the hydrologic pattern through the year as a result of the Project. Some beneficial effects for fish would result from increased and prolonged flows in summer. In general though, water volumes would average about 80 percent of that received at the present time. As a result of the Project, North Dakota could declare "severe drought" conditions more frequently than in the past and therefore, would deliver lower flows.

The high nutrient status of the Manitoba reaches of the Souris is likely to increase as a result of the Project and the greater incidence of algal blooms and low oxygen conditions may adversely affect the river fishery as well as degrade water quality in Manitoba. Low oxygen water flushed from the refuges in late winter as part of pre-flood drawdown may induce winterkill in overwintering fish.

Overall, the effect of the Project is expected to be a net loss of productive fish habitat in Manitoba.

Mitigation Measures

Saskatchewan: Opportunities exist to achieve a net gain in fish habitat if available management options regarding operation of the reservoirs, manipulation of water levels and active habitat enhancement are exploited. This can be done best through a comprehensive fisheries management plan for the Rafferty and Alameda reservoirs and the downstream reaches of the Souris to the international boundary.

While providing added aeration and improving water quality, weirs can block fish migrations and limit productive capacity. Provision of fish passage around these obstacles can offset these negative effects. Fish screens would prevent entrainment and entrapment of fish during water transfer operations.

Mitigation for mercury contamination in fish should include monitoring and the development of consumption guidelines.

North Dakota: The somewhat limited options for mitigation of potential effects on the Lake Darling fishery were set out by the U.S. Army Corps of Engineers. The most obvious way to mitigate impacts to the fishery is to maintain higher water levels in the lake. Under the proposed hydrologic regime, this could only be achieved at the expense of lower water levels in the wildlife refuges, with consequent effects on waterfowl habitat and productivity. Alternatively, additional water could be obtained from Canada, though the likelihood of excess supply is minimal. Water quality in the lake could be improved by installation of mechanical aerators. At the scale required, this is an expensive undertaking, and it would produce open water conditions in winter, possibly inducing waterfowl to overwinter on the lake. An alternative option would be to subdivide Lake Darling into a smaller fishery pool, within which a fishery could be maintained, and a water supply impoundment for downstream allocation.

If carp infestations occur, it is not likely that they could be controlled by inducing winterkill conditions in the J. Clark Salyer NWR.

Manitoba: Loss of fisheries habitat can be prevented in Manitoba only if the province continues to receive the same volume of water as at present, and this would require a change in the operating plan for the Project. In order to achieve 'no net loss' of fish habitat, mitigation and/or compensation would be required to off-set adverse impacts which would result from lower annual flows, changes in the flow regime and altered water quality. For example, the use of mechanical aerators could reduce the anoxic condition of water entering Manitoba. Gains in habitat could be achieved if an increase in year-round flows was possible.

Manitoba Fisheries Branch has indicated that it would cooperate with North Dakota in a planned winterkill program to eliminate carp from the area. Losses of sport fish could be partially mitigated by salvage of stranded fish or by allowing increasing harvest in winterkill years to reduce waste. Overall, an improved sport fishery could be considered as mitigation for those periods when all sport species would be sacrificed through induced winterkill.

Residual Impacts

Low flows downstream of the reservoirs in Saskatchewan would produce residual effects on fish populations in the mainstem Souris. Significant adverse effects would be experienced by the Lake Darling fishery. Spawning success of northern pike and yellow perch in Manitoba would be adversely affected by lower but prolonged flood peaks in early spring.

Lower than historic annual volumes of water and altered water quality would lead to an overall decline in fishery values if lost and degraded fish habitat is not adequately compensated for.

Information Deficiencies

Insufficient information exists to assess the effect on fisheries of the filling period of the reservoirs and the proposed operational plan. Sufficient information does not exist on fish habitat in the Souris River in Manitoba. The significance of Lake Darling and its fish populations to the downstream section of the Souris River in Manitoba is unknown.

Federal Lands

Federal land holdings in the Canadian portion of the Souris River basin total 59 937 ha. These consist of 99 properties owned by federal departments. Agriculture Canada is responsible for the largest share of these properties; it owns 59 695 ha. Of all of these holdings, only two would be directly impacted by the Project: the Estevan - Cambria Community Pasture and the Lomond #1 Community Pasture. These pastures cover about 12 200 ha. Title for both of these holdings is held by Agriculture Canada. However, the pastures are administered by the Prairie Farm Rehabilitation Administration (PFRA).

The Estevan - Cambria Community Pasture is located south of the Souris River 5 to 11 km northwest of the proposed Project and contains 2705 ha of land, approximately 42 quarter sections. The Lomond #1 Community Pasture is located in the extreme northwest corner of the Rural Municipality of Lomond #37 and contains 9502 ha of land, or 148 quarter sections.

Improvements made to both pastures include boundary fences, cross fences, dugouts and corrals. A stock watering and irrigation reservoir has been constructed in the extreme northwest corner of the Lomond #1 Pasture. Information on the economic value of the pasture lands and associated improvements, and its effects on patrons' farm viability is not readily available.

Project Impacts

Two direct impacts would occur on federal lands as a result of the Project: loss of pasture land and loss of access. The Project would have a direct effect on the carrying capacity of the community pastures and therefore an indirect impact on the economic viability of the patrons utilizing these pastures.

In the Estevan - Cambria pasture, the total land area affected would be approximately 850 ha, or 32 percent of the total area. At FSL, the pasture would become a long peninsula between fingers of bays extending westward from the main reservoir. Such areas would be difficult and costly to fence and would be hard to manage as a pasture. As well, additional land would be flood prone to an elevation of 554 m which would be the maximum flood level (MFL). Access to pasture headquarters would be disrupted since the Project would flood the main access road.

The main Rafferty reservoir would not flood the Lomond #1 pasture. Increased elevations in Roughbark and Jewel creeks would flood about 9 percent of the pasture and divide it into three separate areas. In addition to the lost land, approximately 500 ha would be prone to flooding, up to an elevation of 554 m (MFL). The main access road would also be flooded.

Mitigation Measures

The Project was approved by the Saskatchewan Minister of the Environment and Public Safety with

several conditions, one of which affected federal lands. Section 7 of the February 15, 1988 Ministerial Approval, stated:

"the proponent replace community pasture lands which are rendered inoperable by the development on a carrying unit for carrying unit basis or as is otherwise agreed to by those responsible for the community pastures in question."

The SBDA has subsequently submitted a mitigation plan to PFRA that would involve replacing all lost land with land of equivalent carrying capacity. This plan has been deemed acceptable, in principle, by PFRA.

Rare and Endangered Species

Although Canada has no direct legislative mandate for the management of rare and endangered wildlife, the federal government participates cooperatively with the provinces, and on an international level, in their conservation and protection. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was established in 1977. It is composed of federal, provincial, and non-government representatives from agencies across Canada and is responsible for establishing the status of wildlife species within Canada. COSEWIC publishes a list of endangered plants, birds, fish, reptiles, amphibians and mammals annually and provides relevant literature on classified species. Under COSEWIC, a "species" may mean any species, subspecies, or geographically separate population. Species status is defined by the committee as one of the following:

Rare Species: any indigenous species of fauna or flora that, because of its biological characteristics, or because it occurs at the fringe of its range, or for some other reason, exists in low numbers or in very restricted areas in Canada but is not a threatened species.

Threatened Species: Any indigenous species of fauna or flora that is likely to become endangered in Canada if the factors affecting its vulnerability are not reversed.

Endangered Species: any indigenous species of fauna or flora whose existence in Canada is threatened with immediate extinction through all or a significant portion of its range, owing to the action of man.

Extirpated Species: Any indigenous species of fauna or flora no longer existing in the wild in Canada but existing elsewhere.

Extinct Species: Any species of fauna or flora formerly indigenous to Canada no longer existing elsewhere.

In the United States, species are protected by the Endangered Species Act of 1973.

Project Impacts - Fauna

The construction and operation of the Project may adversely affect 11 species on the COSEWIC list. These species are shown in Table 7.

Saskatchewan: The Project would not significantly affect those species that rarely occur in the study area. Such species include Cooper's hawk, the great gray owl, the whooping crane, peregrine falcon and the loggerhead shrike. Cooper's hawk and the great gray owl have been sighted very infrequently in the study area, while the whooping crane and peregrine falcon are classed as "occasional migrants" in the study area. The valley habitat is not suitable for the loggerhead shrike, and therefore it is unlikely that this species would nest within the study area.

Project construction could result in a temporary displacement of the prairie long-tailed weasel, which prefers ecotones close to free-standing water. However, any disturbance which may

Table 7: Rare, Endangered and Threatened Fauna in the Project Area.

Species	Scientific Name	Current Status
Birds		
Baird's sparrow	Ammondramus bairdii	Threatened
Burrowing owl	Athene cunicularia	Threatened
Cooper's hawk	Accipiter cooperii	Rare
Eastern Bluebird	Sialia sialis	Rare
Ferruginous hawk	Buteo regalis	Threatened
Great gray owl	Strix nebulosa	Rare
Loggerhead shrike	Lanius ludovicianus	Threatened
Peregrine falcon	Falco peregrinus tundrius	Threatened
	Falco peregrinus anatum	Endangered
Piping plover	Charadrius melodus	Endangered
Whooping crane	Grus americana	Endangered
Mammals		
Prairie long-tailed weasel	Mustela frenata longicauda	Threatened

occur would be short-term and should have no significant effect on the total southern Saskatchewan population, which is not considered threatened in this part of its range. The eastern bluebird is a rare but confirmed breeder in the Souris valley. It is tolerant of some disturbance and therefore, should experience only short-term impacts during channel improvement works.

The Project's greatest impact on rare and endangered species would result from reservoir creation and inundation. Any land clearing that occurs prior to reservoir filling, as well as inundation of the floodplain habitat, would affect species such as the ferruginous hawk and Baird's sparrow. Prime habitat for Baird's sparrow is ungrazed native and tame grasslands, and it is primarily this type of habitat that would be flooded during the filling period. This could have a significant impact on the population. However, additional data on nest sites and habitat usage is required.

The creation of the Rafferty Reservoir could affect about 1 percent of the known ferruginous hawk nest sites in Canada. This loss is considered to be significant. The largest impact on this species would be the reduction of foraging potential as the reservoir would flood large tracts of pasture land which serve as habitat for ground squirrels, the primary prey of the ferruginous hawk. This could be offset with the creation of additional pasture land, as proposed in the mitigation plan for federal lands, provided it is suitable habitat.

Reservoir operation may impact additional habitat for rare species, particularly when the reservoir is surcharged above FSL to 554 m (MSL). Impacts that have already been identified would be magnified with the additional loss of habitat. However, such reservoir surcharges are expected to be infrequent and therefore impacts should not be significant.

Benefits from the Project may accrue to the prairie long-tailed weasel and piping plover over the long term. The creation of Rafferty Reservoir would result in additional free-standing water with adjacent potential habitat for the prairie long-tailed weasel. As well, the creation and enhancement of beach habitat along the reservoir shoreline would provide potential habitat for piping plover. Long-term benefits from additional shoreline creation may also accrue to migratory species such as whooping cranes.

North Dakota: An assessment of impacts to endangered and threatened species in North Dakota was undertaken by the U.S. Army Corps of Engineers. The area contains no critical habitat for the bald eagle, an endangered species in the U.S., and therefore it was not considered to be adversely impacted by the Project. Additionally, associated projects to be undertaken in the United States, that would result in a one-foot rise in Lake Darling, would not have any adverse impacts on protected species, or their habitat, in North Dakota.

Manitoba: Impacts to rare and endangered species are unknown because there is little available baseline data. However, it is unlikely that rare and endangered species or their prey would be significantly affected.

Mitigation Measures - Fauna

Mitigation measures could be undertaken to provide alternate or artificial nest sites for ferruginous hawks, to create and enhance shoreline habitat suitable for piping plovers, and to develop ecological reserves in the vicinity of the Project that would benefit other species. In the SBDA EIS, the development of alternate nest sites for ferruginous hawks was identified as a mitigative measure. It may also be necessary to provide additional protection (e.g., fencing) to known nesting sites. Channelization work should be scheduled to avoid the spring nesting period.

Table 8: Rare Flora of National Significance in the Souris River Valley

Scientific Name	Common Name
Andropogon hallii Hack.	Hall's bluestem
Aristida longiseta Steud.	Red three-awn
Asclepias verticillata L.	Whorled milkweed
Bouteloua curtipendula (Michx.) Torr.	Side oats grama grass
Buchloe dactyloides (Nutt.) Engelm	Buffalo grass
Carex gravida Bailey	Heavy-fruited sedge
Carex tetanica Schkuhr	Rigid sedge
Cypipedium candidum Muhl	Small white lady's-slipper
Eleocharis engelmannii Steud	Engelmann's spike-rush
Euphorbia geyeri Engelm.	Prostrate spurge
Gentiana andrewsii Griseb. var dakotica G. Nels.	Jerusalem artichoke
Lomatium orientale Coult. and Rose	White-flowered prairie parsley
Microseris cuspidata (Pursh) Schultz-Bip.	Prairie false dandelion
Mimulus glabratus H.B.K. var. fremontii (Benth.) Grant	Small yellow monkey-flower
Panicum wilcoxianum Vasey	Witch grass
Pellaea glabella Mett. var occidenialis (E. Nels.) Butters.	Smooth cliff-brake
Polygala alba Nutt.	White milkwort
Schedonnardus paniculatus (Nutt.) Trel.	Tumble grass
Tradescantia occidentalis (Britt.) Smyth	Western spiderwort

The creation of shoreline habitat along the reservoir could be beneficial to piping plover populations. However, habitat enhancement may be required to increase suitable habitat. If the beaches experience heavy recreational use, protection of known nest sites could be required. The creation of new community pastures should mitigate habitat losses for the burrowing owl.

Mitigation actions have not been identified for either North Dakota or Manitoba as little or no impact is predicted to occur from the Project.

Residual Impacts - Fauna

Residual Impacts in Saskatchewan would include potential loss of nest and foraging habitat for the ferruginous hawk and loss of productive nesting habitat for Baird's sparrow, both caused by inundation of existing habitat.

Information Deficiencies - Fauna

Quantitative information on local ferruginous hawk, burrowing owl and Baird's sparrow populations is required before a more precise assessment of the Project's impact on these species can be made. Information on habitat quality in the reservoir area relative to the surrounding area is needed to prepare mitigative plans for these species.

Precise baseline data on population numbers and extent of rare and endangered fauna within the Manitoba portion of the Souris Valley is presently unavailable.

Project Impacts - Flora

Any adverse impacts that would result in a reduction of plant species within Canada should be viewed with concern. A reduction in plant numbers below some minimum value lessens genetic diversity and, therefore, the entire species has a lower chance of producing individuals that can cope with slight changes in environmental conditions. As genetic diversity decreases, a species becomes less able to adapt to environmental changes and may eventually become extinct. A more physical effect of a population growing too small is that the flowers which do bloom have a poorer chance of being pollinated and hence of setting seed. This could result in the extirpation of the species in local areas. That a plant which is rare in Canada may possess a main range in the United States in which it is in no present danger of extinction, has nothing to do with the issue or the responsibility to protect a diverse environment in Canada.

Saskatchewan: The Souris River drainage basin provides habitat for a number of plant species that have been identified as rare in Saskatchewan and in Canada. The majority of rare Saskatchewan plants that occur in the Souris Valley are located at the extreme northwest corner of their range. Most are widely distributed in the eastern-hardwood forests and the former tall-grass prairies of the american midwest.

Nineteen species have been identified as having national significance and are listed in Table 8.

The Project would impact rare plant species through four mechanisms:

- simple flooding and drowning out,
- suppression of the occasional spring flood of all or much of the valley bottom,
- irrigation of benches and valley bottom flats, and
- construction

Simple flooding or drowning out would affect species located upstream of the dam sites and would be a local phenomena. Witch grass is found in the proposed Rafferty Reservoir area, and inundation would reduce the Canadian population of this species. Tumble grass, whorled milkweed and buffalo grass may also be affected

as well as side oats grama grass found in the Alameda Reservoir area.

A reduction in spring flooding would adversely affect plants downstream of the dam site, and the impacts would occur in North Dakota and Manitoba. Impacts would be caused directly by a reduced water supply for floodplain species, or indirectly by reduced recharge waters for local aquifers which feed back soil moisture to the floodplain during the summer period. The nationally significant species that would be affected by an altered hydrological regime are buffalo grass, whorled milkweed, heavy-fruited sedge, tumble grass and white-flowered prairie parsley.

If irrigation projects are developed on the floodplain, then the natural vegetation would be cleared and rare species and their necessary habitat would be lost. White-flowered prairie parsley occurs on terraces above the flood plains and could be adversely impacted by irrigation development.

Populations of whorled milkweed, buffalo grass and side oats grama grass are known to occur within one kilometer of planned construction activities for the Rafferty dam and could be adversely affected.

The Alameda dam would not have as pronounced an impact as the Rafferty Dam because of the narrowness and high gradient of the bottomlands and benches in Moose Mountain Creek. As well, the reservoir would be smaller.

North Dakota: Rare plants in the North Dakota portion of the Souris Valley are not expected to be adversely affected by the Project.

Manitoba: In Manitoba, the following nationally significant plants could be affected by the Project: heavy-fruited sedge, buffalo grass, whorled milkweed, and tumble grass. These species occur on the valley flood plain and could be adversely impacted by the altered hydrologic regimes.

Mitigation Measures - Flora

Mitigation is not possible for plants lost by inundation of the reservoirs or through reduction in downstream flow. Adverse impacts occurring from channelization could be reduced with appropriate construction practices. In Saskatchewan, irrigation could be developed in a manner that minimizes impacts on rare plants.

Information Deficiencies - Flora

Studies that examined unique habitat, such as areas of ground water seepage (calcareous or saline) and bare flats that are occasionally flooded, are required.

Studies should be undertaken in the reservoir areas which would be inundated, to determine the distribution and abundance of rare plants in this area. Should the Project proceed, botanical surveys should be continued so that the actual impacts of the Project on rare plant species can be ascertained. The SBDA has proposed to monitor plant communities in the Souris River valley over the long term.

Navigable Waters

Canada retains exclusive authority over matters of navigation. This authority empowers it to regulate works in navigable waters under the Navigable Waters Protection Act (NWPA) which is administered by Transport Canada.

In administering the NWPA, Transport Canada requires that an 'owner' submit an application outlining the nature of the proposed works. If it is determined that the work does not interfere substantially with navigation, then formal approval is not required and the department issues an exemption. If the work does interfere with navigation, the Minister would issue a licence with terms

and conditions to protect navigation. However, crown corporations are exempt under the Act and therefore, the Saskatchewan Water Corporation did not apply for a licence for the Project.

Project Impacts

While the Souris River and Moose Mountain Creek could not be considered major waterways, they are navigable by small craft and the Project would constitute a 'substantial interference with navigation'. Improperly marked spillways, intake structures or other Project structures could be hazardous to recreational activities.

Mitigation Measures

Although the Saskatchewan Water Corporation, as a crown corporation, is not required under the Act to mitigate potential impacts on navigation resulting from the Project, the opportunity exists for alleviating any potential impacts. Impacts and concerns for public safety can be mitigated through design and construction procedures, and proper marking of hazards to navigation. Should the Project proceed, the Minister of the Environment could stipulate that the Proponent meet the requirements of the NWPA.

PUBLIC REVIEW PROCESS

A total of 281 briefs, either oral or written, were received from the public. Questions and comments which relate directly to the IEE have been addressed in the final IEE. The following section summarizes the basic issues which were raised during the public review process.

What is the role of an IEE?

The IEE is an initial screening process that provides a systematic assessment of environmental impacts of the Project, based on existing knowledge. It also describes mitigative measures and identifies critical knowledge gaps. If critical information gaps and/or unmitigable environmental impacts, are identified in the IEE then, additional studies, such as an EIS, may be required before the Project proceeds. Alternatively, or in conjunction with additional studies, a Public Review Panel may be undertaken.

What was the scope of the Rafferty-Alameda IEE?

As the initiating department for the federal environmental review process, Environment Canada was in a unique position since it was not the Project Proponent or a sponsor. Environment Canada therefore focused the IEE on areas of federal responsibility pertaining to the Project. The public and other agencies had indirect input into the scoping process because Environment Canada reviewed documents from public correspondence with the Minister of the Environment, the provincial public review process, the Canada-Saskatchewan-Manitoba Souris River Basin study and carried out discussions with other agencies while scoping the IEE.

Will an independent review of the Project be conducted?

Environment Canada is not the Project Proponent nor is it a sponsor of the Project. The role of the federal task force was to assess the available information base and provide guidance to the Minister on the licencing of the Project under the IRIA.

How does the change in location of the Alameda Reservoir affect the EAR Process?

From a federal viewpoint, the change in location does not significantly affect any areas of federal concern.

Is there a need for a basin-wide assessment of the Project?

Independent studies have been conducted on the Project impacts in Saskatchewan, North Dakota and Manitoba. As a result, downstream impacts are uncertain in some jurisdictions. Cooperative management of the Souris River would provide a means of assessing the Project impacts and mitigation strategies at a basin-wide level. An inter-jurisdictional management plan would also provide the framework for addressing federal concerns.

How does the Project affect the hydrologic regime of the Souris River Basin?

The Rafferty-Alameda Project was designed to reduce the erratic nature of water availability in the basin by storing water during wet years for use in dry years. Flood control and drought proofing benefits would therefore be realized. However, major floods and severe drought could still occur in the area causing economic losses.

Will ground water be pumped into Rafferty Reservoir?

There are no plans for using ground water to augment water levels in the Rafferty Reservoir. Public concern about possible ground water pumping could be addressed by a specific prohibition in any future IRIA licence.

Why doesn't the IEE evaluate Project alternatives?

Environment Canada is not a proponent or sponsor of the Project, and thus cannot evaluate or comment on the economic desirability of one project alternative over another; this is a provincial decision. Federal action is focused, as is the IEE, on issues of federal jurisdiction and concern that are affected by the Project.

Is the Project a sustainable development project?

The question concerns the Project's ability to sustain the multipurpose uses, which have been identified by the Proponent, for both present and future generations. A basin-wide management plan which integrated the needs of all jurisdictions in the short and long term would best meet this objective.

Has the public been completely and accurately informed about the Project?

Numerous public meetings have been held throughout the basin by proponents, opponents, a provincial Board of Enquiry, and Environment Canada. As well, information has been dispersed utilizing various media formats. As a result, the public is as well informed as can be reasonably expected on the technical aspects and environ-

mental concerns of the Project. However, it is possible that expectations have been unrealistically increased with respect to all of the benefits associated with the reservoirs multi-use purposes. As previously stated, a basin-wide management plan would ensure that maximum water use is achieved while still recognizing the limits of the resource.

Will water export to the U.S. occur as a result of the Project?

A link from the South Saskatchewan River, through the Qu'Appelle River, to the Souris River is potentially possible. This would provide a secure mountain-fed source of water which could be exported to the United States. However, no such actions are contemplated and they are not part of the Rafferty-Alameda Project proposal. The federal government, as well as the governments of Alberta and Saskatchewan, are all on record as opposing water export through inter-basin diversion. As well, federal Trade Ministers have stated on numerous occasions that water is not part of the Free Trade Agreement.

What happens to the downstream flows while the reservoirs are filling?

Saskatchewan must comply with the 1959 Interim Measures which states that Saskatchewan "shall not diminish the annual flow of the river at the Sherwood Crossing by more than fifty percent of that which would have occurred in a state of nature." Therefore, downstream flow into North Dakota cannot be less than 50 percent of the natural flow. The 1959 Interim Measures also provide for a regulated flow of 0.566 m^3/s from North Dakota to Manitoba during the months of June to October inclusive. Only under clearly defined circumstances of "severe drought" will this flow be reduced.

What defines the "severe drought" criteria in North Dakota?

The operation of the national wildlife refuges and the level of Lake Darling are instrumental in defining "severe drought". Specifically, "severe drought" occurs when the combined storage in Lake Darling and in the five lower refuges drops below 66 600 dam^3 (54 000 acre-feet) and continues until the combined storage exceeds 70 300 dam^3 (57 000 acre-feet).

How does the Project affect water quality in Manitoba?

A scientific analysis of the Project impacts on all water quality parameters at the North Dakota-Manitoba boundary has not yet been completed and reviewed by all jurisdictions. However, studies on some parameters have been completed by the SBDA and Environment Canada, and the Manitoba government has commissioned a water quality study. The formulation of water quality objectives, to be applied at the border, would ensure adequate water quality for downstream users. Such objectives could be developed and managed within a basin-wide management plan.

What is the impact of the Project on waterfowl habitat?

The Project would result in substantial losses of waterfowl habitat. If unmitigated, these losses would compromise the intent of the North American Waterfowl Management Plan (NAWMP). Therefore, all waterfowl habitat lost or adversely affected as a result of the Project must be mitigated on the basis of in-kind acre-for-acre replacement. The IEE determined duck loss figures which should be used by the Proponent in formulating mitigation plans.

Will wetland drainage increase as a result of the Project?

The Province of Saskatchewan has given assurances that drainage of off-river wetlands will not occur for the purpose of increasing the water supply in either the Rafferty or Alameda reservoirs. There is presently a moratorium on wetland drainage in the Souris Basin.

How does the Navigable Waters Protection Act affect the Project?

The Act applies to any body of water which can be navigated by any kind of floating vessel, including recreational vessels. Therefore, the NWPA applies to the construction of dams on the Souris River and on the Moose Mountain Creek however, the SBDA, as a Crown agency, is exempt from the NWPA.

What are the requirements of a basin-wide management plan?

An inter-jurisdictional management plan would require discussions between the Canadian, United States, Saskatchewan, Manitoba and North Dakota governments. The roles of the existing Boards under the IJC, as well as the International Souris River Board of Control, would have to be re-evaluated. Data bases on water quantity, quality and use would have to be developed for the entire basin. Operating guidelines for the Project, as well as other water control structures within the basin, would also have to be developed. Such a plan has been identified in the IEE as a desirable mechanism for addressing federal concerns as well as other jurisdictional concerns.

SUMMARY REMARKS

This document summarizes the findings of the Rafferty-Alameda Initial Environmental Evaluation. The IEE was prepared by an inter-departmental task force led by Environment Canada. The purpose of the IEE was to document and assess the potential environmental impacts of the Project, as part of the federal EARP. Environment Canada identified six areas of federal responsibility that were considered in the IEE. These were:

- transboundary water issues arising from Canada/U.S. treaties and/or related to the protection of the interests of downstream users;
- protection of migratory birds and their habitat;
- protection of fish and fish habitat;
- federal lands;
- protection of rare and endangered species and their habitat; and
- protection of navigable waters.

Project impacts outside these areas of federal responsibility were not dealt with in the IEE.

A draft IEE was prepared which provided technical information on the nature, extent and significance of potential Project impacts, proposed mitigation measures, residual impacts and information deficiencies. Those impacts deemed to be "significant" or "moderate" are summarized in Table 9. Table 10 summarizes "significant" or "moderate" information deficiencies.

The draft IEE was reviewed by the public. Individuals and groups were encouraged to present written briefs to Environment Canada and/or attend public meetings held throughout the Souris River basin. Public concerns were then incorporated into the recommendations and conclusions of the final IEE.

The final recommendations of the IEE are:

- Where significant impacts are identified in areas of federal responsibility, the responsible agencies should develop and implement mitigation plans;
- Prior to a federal decision on the Project, information deficiencies must be addressed by the responsible agencies. This information would also ensure an adequate data and information base for post-Project operation and monitoring;
- To ensure that all concerns are considered, Environment Canada could provide continuing opportunity for public input on federal areas of responsibility with respect to the Project.

Public response to the draft IEE and the Project are provided in the Public Consultation Process document. As well, the moderator of the public meetings prepared an independent Moderator's Report. These documents, along with the technical IEE were presented to the Minister of the Environment to guide his decision on licencing the Project under the International Rivers Improvements Act.

Table 9: Summary of Adverse Environment Impacts Caused by Altered Flows and Lake Levels

SIGNIFICANT IMPACTS

* **Reduced Downstream Flows:** Flow reductions during years of normally low flow would aggravate an already poor water quality situation in the Souris River in Manitoba. The recreational value of the river would be diminished because of earlier and longer periods of instream biological growth, longer periods of reduced dissolved oxygen, and increased incidence of high free ammonia concentrations. Mitigation options should include flow augmentation alternatives involving modified operational plans and structural considerations in North Dakota, Saskatchewan and Manitoba.

* **Waterfowl Productivity:** Within Saskatchewan and North Dakota the Project would have significant adverse effects on waterfowl production. Complete mitigation of waterfowl impacts is feasible; mitigation plans must be developed for Saskatchewan and North Dakota before the Project proceeds.

* **Lake Darling Fisheries:** The flows entering North Dakota and would be reduced by 44 percent and associated water quality effects, would result in a decline and possible elimination of the fish population in Lake Darling. Mitigation options are limited.

* **Fish Habitat:** The Project would result in losses of riverine habitat in Saskatchewan. These losses would be fully mitigated through replacement with reservoir habitat. The Project should achieve'no net loss' of productive habitat in Saskatchewan. In Manitoba the Project would result in the loss or alteration of productive fish habitat. Compensation for this loss or alteration would be required.

* **Federal Lands:** Approximately 1700 ha of federal community pasture lands would be lost to the reservoirs. Full mitigation of the impacts would be achieved through the replacement of pasture lands with lands of equal carrying capacity.

* **Rare and Endangered Species (Plants and Animals):** The Project would have significant adverse effects on the ferruginous hawk (THREATENED) and possibly seven plant species of national significance through inundation by the Reservoirs or altered downstream flows through to Manitoba. Opportunities for mitigation would be limited. Over the long term, information on the distribution and abundance of rare plant species in the flood plain is required for Saskatchewan and Manitoba.

* **Navigable Waters:** Both Rafferty and Alameda Reservoirs would impact on navigation. Impacts and concerns for public safety can be mitigated through design and construction considerations, and proper marking of hazards to navigation.

MODERATE IMPACTS

* **International Water Quality:** Reservoir releases would intermittently impact on downstream water quality (free ammonia, dissolved oxygen and dissolved salts). International water quality objectives for both boundaries would be required to determine the acceptability of Project-induced water quality impacts. Mitigation could be accomplished through multi-level outlets and coordinated reservoir releases.

* **Mercury in Fish:** Mercury levels in fish tissue would increase in the reservoirs and possibly downstream. Mitigation options are not well understood. Monitoring and the development of consumption advisories are required in order to protect the public.

* **Baird's Sparrow:** Inundation of the Souris River valley by Rafferty Reservoir would reduce critical habitat and local populations of this THREATENED species. Further studies are required to confirm the extent of the loss.

Table 10: Summary of Information Deficiencies

SIGNIFICANT DEFICIENCIES

* The basic data for Saskatchewan from 1974 to 1981 should be reviewed. The hydrology data in Saskatchewan, North Dakota and Manitoba should be updated to 1988, including data on existing and proposed water uses. These data are not required to assess the overall impact of the Project, but are critical for development of a water management plan.

* Operational criteria used in the hydrologic model have been evolving continually since the preparation of the SBDA's EIS. A water management plan must be developed which would include Saskatchewan's operations of the Project, the operation of the national wildlife refuges in North Dakota, and account for Manitoba's entitlement.

* International water quality objectives against which impacts on transboundary water quality can be assessed do not exist. If the Project proceeds, formulation of international water quality objectives should be undertaken immediately for those parameters which are considered most likely to be affected.

* The EIS's from the SBDA and the U.S. Army Corps of Engineers do not consider the collective impacts of the Project and the Souris River Basin Project on the quality of the Souris River at the North Dakota-Manitoba boundary.

* The operation of the national wildlife refuges in North Dakota affect the water quality at the North Dakota-Manitoba boundary. A precise operating plan is required to assess the water quality implications and opportunities for mitigation.

* Comprehensive mitigation and monitoring plans for waterfowl production would be required before a decision could be made on whether the Project can proceed.

* Insufficient information exists on fish habitat in the Souris River in Manitoba. As well, the significance of Lake Darling and its fish populations to the downstream reaches of the Souris River in Manitoba is unknown. Such information is required in order to accurately predict impacts of the Project on fish and to determine suitable compensation options in order to achieve 'no net loss' of productive fish habitat.

* Information and data are lacking for comparative evaluations of habitat quality in the flooded area in terms of nesting and foraging value and the surrounding range for the ferruginous hawk.

* The distribution and abundance of rare plant species in the Souris River flood plain in Saskatchewan and Manitoba needs to be studied in more detail. Particular emphasis should be placed on the reach to be inundated by the Rafferty Reservoir.

MODERATE DEFICIENCIES

* Spring flood-flow rejuvenation of the Souris River downstream of the Project would be reduced, relative to existing conditions. It is not known how the effects of this would be manifested in the aquatic ecosystem.

* The water quality models used by the proponent have not been fully field tested, calibrated or verified within the Souris River basin, although some testing was undertaken in 1989. This deficiency places some doubt upon the results.

* Data should be collected on the distribution of riparian and upland waterfowl habitat types, and on the size and composition of the resident breeding waterfowl population, along the Souris River in Manitoba. These data are required in order to substantiate the expectation that the Project would not adversely affect waterfowl production along the Souris in Manitoba.

* Quantitative baseline information is lacking on the status of Baird's sparrow in the Souris valley, particularly in the vicinity of the Rafferty and Alameda Dam site.

APPENDIX

Executive Summary of the Rafferty - Alameda
Initial Environmental Evaluation

EXECUTIVE SUMMARY

Background

The Saskatchewan Water Corporation, a Crown agency responsible for water management in the province of Saskatchewan, submitted an application to Environment Canada for a licence for the proposed Rafferty-Alameda Project (henceforth referred to as "the Project") under the International River Improvements Act (IRIA) on January 07, 1988. The purpose of the IRIA is to ensure that the national interest is protected in water resource developments in international rivers. The licence was subsequently issued on June 17, 1988. On April 10, 1989, the Federal Court of Canada quashed the IRIA licence and required Environment Canada to comply with the Environmental Assessment and Review Process (EARP) Guidelines Order in considering the application for a licence.

As the initiating federal department in terms of regulatory functions under the IRIA, Environment Canada identified environmental implications that affect the following areas of federal responsibility:

- transboundary water issues arising from Canada's obligations under Canada/U.S. Treaties and related to the protection of North Dakota and Manitoba interests as downstream users,
- protection of migratory birds and their habitat,
- protection of fish and fish habitat,
- federal lands,
- protection of rare and endangered species and their habitat, and
- protection of navigable waters.

Project impacts outside these areas of federal responsibility are not dealt with in this Initial Environmental Evaluation (IEE). The project proponent, the Souris Basin Development Authority (SBDA), has previously completed an Environmental Impact Statement which assessed the impact of the Project on areas of provincial concern.

The purpose of this IEE is to document and assess the potential environmental impacts of the Project, as part of the federal EARP. Information is provided on the nature, extent and significance of potential project impacts, proposed mitigation measures, residual impacts and information deficiencies.

To complete this IEE, it was essential that public concerns with the project be identified and incorporated into the recommendations and conclusions of the final IEE. This was achieved by public review of a draft IEE through public meetings held throughout the Souris River basin. Individuals or groups interested in the Project were also encouraged to present written briefs to Environment Canada.

In considering this IEE, the EARP Guidelines Order requires that the federal Minister of the Environment make a decision within one of four general areas:

(a) environmental effects are understood and can be mitigated, and the Project therefore may proceed with prescribed mitigation and monitoring measures,

(b) environmental effects are not completely understood and additional studies are required before a decision can be made on the project,

(c) environmental effects are significant or there is major public concern or both a public review by a Panel is therefore required, or

(d) environmental effects are significant and unacceptable, in which case the proposal must either be modified and subsequently re-screened or be abandoned.

Project Description

The Souris River rises in southeastern Saskatchewan and flows south into North Dakota before turning northeasterly to enter Manitoba and join the Assiniboine River near Brandon. Approximately 35 percent of the basin is in Saskatchewan, 39 percent is in North Dakota and 26 percent is in Manitoba. Major tributaries to the Souris in Saskatchewan are Moose Mountain and Long creeks; in North Dakota, Des Lacs, Wintering and Deep rivers; and in Manitoba, Gainsborough Creek and Antler River.

The Project, as defined by the SBDA includes:

- Rafferty Dam and Reservoir on the Souris River, six km northwest of Estevan,
- Rafferty to Boundary Reservoir Diversion Channel,
- downstream channelization from Rafferty to near the Shand Thermal Generating Station, and
- Alameda Dam and Reservoir on Moose Mountain Creek, four km northwest of Oxbow.

The Project is designed to provide flood protection to downstream areas and to provide a more reliable source of water supply to the region. Major flood protection benefits would accrue to the city of Minot, North Dakota, and the United States has conditionally committed $41 million (1985 U.S. dollars) to the project in return for flood protection to the 1:100 level. Saskatchewan has designed the Project to provide a capability to retain a higher percentage of the natural flow in the Souris River.

A number of associated projects are planned to utilize the more reliable supply of water that would be provided by the Project. These include:

- cooling water for the Shand Thermal Generating Station,
- increased irrigation development, and
- development of recreational and tourism facilities.

The Project would also be operated in conjunction with the existing Boundary Reservoir to increase the storage during flood events and to augment releases to meet flow commitments at the international boundary.

In addition to flood control at Minot, the U.S. Army Corps of Engineers plans to undertake a number of modifications in the United States, known as the Souris River Basin Project, that would be operated in conjunction with the Project. Major features include:

- modification to the Lake Darling dam outlet structure,
- modification to control structures in the Upper Souris National Wildlife Refuge,
- modification to control structures in the J. Clark Salyer National Wildlife Refuge, and
- construction of urban levees at selected sites in North Dakota.

Summary of Adverse Environmental Impacts

If the Project proceeds, altered flows and lake levels within the Souris River basin are expected to cause adverse environmental impacts in a number of areas. These are summarized as follows:

SIGNIFICANT IMPACTS

* **Reduced Downstream Flows:** Flow reductions during years of normally low flow would aggravate an already poor water quality situation in the Souris River in Manitoba. The recreational value of the river would be diminished because of earlier and longer periods of instream biological growth, longer periods of reduced dissolved oxygen, and increased incidence of high free ammonia concentrations. Mitigation options should include flow augmentation alternatives involving modified operational plans and structural considerations in North Dakota, Saskatchewan and Manitoba.

* **Waterfowl Productivity:** Within Saskatchewan and North Dakota the Project would have significant adverse effects on waterfowl production. Complete mitigation of waterfowl impacts is feasible; mitigation plans must be developed for Saskatchewan and North Dakota before the Project proceeds.

* **Lake Darling Fisheries:** The flows entering North Dakota and would be reduced by 44 percent and associated water quality effects, would result in a decline and possible elimination of the fish population in Lake Darling. Mitigation options are limited.

* **Fish Habitat:** The Project would result in losses of riverine habitat in Saskatchewan. These losses would be fully mitigated through replacement with reservoir habitat. The Project should achieve'no net loss' of productive habitat in Saskatchewan. In Manitoba the Project would result in the loss or alteration of productive fish habitat. Compensation for this loss or alteration would be required.

* **Federal Lands:** Approximately 1700 ha of federal community pasture lands would be lost to the reservoirs. Full mitigation of the impacts would be achieved through the replacement of pasture lands with lands of equal carrying capacity.

* **Rare and Endangered Species (Plants and Animals):** The Project would have significant adverse effects on the ferruginous hawk (THREATENED) and possibly seven plant species of national significance through inundation by the Reservoirs or altered downstream flows through to Manitoba. Opportunities for mitigation would be limited. Over the long term, information on the distribution and abundance of rare plant species in the flood plain is required for Saskatchewan and Manitoba.

* **Navigable Waters:** Both Rafferty and Alameda Reservoirs would impact on navigation. Impacts and concerns for public safety can be mitigated through design and construction considerations, and proper marking of hazards to navigation.

MODERATE IMPACTS

* **International Water Quality:** Reservoir releases would intermittently impact on downstream water quality (free ammonia, dissolved oxygen and dissolved salts). International water quality objectives for both boundaries would be required to determine the acceptability of Project-induced water quality impacts. Mitigation could be accomplished through multi-level outlets and coordinated reservoir releases.

* **Mercury In Fish:** Mercury levels in fish tissue would increase in the reservoirs and possibly downstream. Mitigation options are not well understood. Monitoring and the development of consumption advisories are required in order to protect the public.

* **Baird's Sparrow:** Inundation of the Souris River valley by Rafferty Reservoir would reduce critical habitat and local populations of this **THREATENED** species. Further studies are required to confirm the extent of the loss.

A summary of all Project impacts within Saskatchewan, North Dakota, and Manitoba is provided in the following discussion. Information deficiencies are also identified, together with an assessment of their importance in evaluating impacts.

Environmental Impacts - Saskatchewan

As a result of the Project, Saskatchewan would be able to retain a greater share of the available water in the Souris River and provide improved flood protection to downstream areas. The reservoirs would flood considerable areas of existing farm land, wildlife habitat and floodplain plant communities, while providing higher summer flows below the reservoirs. Operation of the reservoirs would also result in higher than normal flows before and after flood events. Accurate flow forecasts would be required to optimize water management.

Water quality in the reaches of the Souris River below the reservoirs would change as a result of the moderating effect of the new large water bodies. The change would be generally positive for flow-dependent indicators of water quality. There would be intermittent periods when anoxic (low dissolved oxygen) discharges from Rafferty would contain relatively high levels of free ammonia which would be toxic to instream aquatic life. Upsurge of nutrients and salts would occur from the soils inundated by the reservoirs. Increases in salts from upsurge would be masked by the concentrating effects of evaporation. Over the long term, there would be an increasing trend in dissolved salts and nutrients. The nutrients would promote algal growth in the reservoir to the extent that reservoir recreation and aesthetics would be negatively affected. Water quality at the Saskatchewan-North Dakota boundary would vary depending on a number of factors related to flow conditions, reservoir levels and filling rates. During the large flood events, the reservoirs would be replenished with higher quality water which would be released over the following few years.

Mitigation of water quality impacts would require management of reservoir releases to minimize impacts on water quality at the boundary. This could be accomplished by diluting releases from Rafferty with the expected better quality water from Alameda, multiport discharges to reduce the effect of anoxic conditions, and control of activities on and around the reservoirs to protect water quality.

Inundation of waterfowl habitat by the reservoirs and downstream channelization would result in reduced waterfowl production in Saskatchewan in the order of 4400 ducks annually. Such losses would be contrary to the intent and objectives of the **North American Waterfowl Management Plan (NAWMP)** and, without adequate mitigation, would constitute a significant impact. Waterfowl losses could be considerably greater if increased waterfowl harvest near the reservoirs and off-river wetland drainage, stimulated by the Project, were permitted to occur. Mitigation of waterfowl losses would require replacement of lost habitat and waterfowl production, together with restrictions on waterfowl harvest near the reservoirs, and controls on wetland drainage. Extensive monitoring would be required in order to determine whether residual impacts on waterfowl existed after mitigation had been applied.

The Rafferty and Alameda dams would block the seasonal movements of fish between areas downstream and upstream of the proposed dam sites. The Project will achieve 'no net loss' of productive fish habitat in Saskatchewan. Losses in riverine habitat would be replaced by reservoir habitat. Mercury levels in fish are expected to increase in the reservoirs and perhaps downstream. Mitigation options available to reduce the impact of mercury accumulation are not well known. Monitoring and the development of consumption advisories would be required in order to protect the public.

Approximately 1700 ha of federal government community pasture lands administered by the Prairie Farm Rehabilitation Administration (PFRA) would be lost to the reservoirs. Mitigation of the impacts could be achieved through the replacement of pasture lands, with lands of equal productivity, by the SBDA.

Population size of a number of rare plants and the ferruginous hawk could be reduced as a result of inundation by the reservoirs or because of a reduction in flood frequency downstream in the Souris River. Irrigation development associated with the Project would affect a number of rare plants. Piping plover habitat may be enhanced by creation of the reservoirs. No mitigation is possible for impacts on rare plants in inundated areas. No mitigation measures were identified for rare and endangered species impacted by altered downstream flows. Lost habitat for some species could be replaced through means such as nesting boxes, and irrigation development could be designed to minimize impacts on rare plants.

Both the Rafferty and Alameda dams would impact on navigation. Impacts and concerns for public safety could be reduced through design and construction considerations and proper marking of hazards to navigation.

The overall impact of the Project on areas of federal responsibility in Saskatchewan, can be considered significant with respect to transboundary hydrology and water quality, migratory birds, fish habitat, federal lands, and navigation. Some uncertainty exists with respect to the extent of impacts on rare and endangered species. There would be 'no net loss' of fish habitat as a result of the Project, however, some concern over mercury levels in fish tissue remains.

Although many of these impacts are primarily of provincial concern, there are important implications for areas of federal responsibility, including downstream effects at the boundary and in North Dakota and Manitoba.

Environmental Impacts - North Dakota

The impacts of the Project in North Dakota would result from direct changes in the flow regime and quality of water crossing the international boundary. In addition, change resulting from the Souris River Basin project and proposed changes in the operation of control structures on the Souris River in North Dakota would further impact downstream uses. The U.S. Army Corps of Engineers prepared an Environmental Impact Statement (EIS) which addressed the impacts and United States concerns related to the project. The impacts and mitigation measures identified here are based on studies

undertaken by U.S. agencies.

The Project would provide major flood control benefits to the U.S. portion of the Souris River, particularly the city of Minot. Due to significant evaporation losses from reservoirs and increased water consumption within Saskatchewan, reduced volumes of water would be available for water users in North Dakota. Operation of the two national wildlife refuges would be affected by an overall reduction in flow volume, combined with prolonged higher flows following the spring peak during flood years. Impacts on water users in North Dakota could be partially mitigated through the operation of national wildlife refuges to optimize water use. Saskatchewan would have to ensure that North Dakota receives their entitled water apportionment.

The quality of water entering North Dakota would depend upon flow conditions, reservoir levels, and the quality of water delivered from Saskatchewan. The quality of Souris River water, if principally from Alameda Reservoir, would improve upon existing conditions. The reservoirs would reduce suspended sediment loading to downstream reaches, positively moderate the extremes in dissolved salt concentrations, and slightly increase the potential relative to existing conditions for toxic levels of free ammonia. Impacts (direct and indirect) from the Project would include reduced water volumes and the frequency of flushing by high spring flows, increase the TDS in the national wildlife refuges, and an unquantified negative effect on refuge trophic conditions despite anticipated reduced annual nutrient loading. Reduced river flows would have downstream implications to stream assimilative and dilution capacity for handling municipal effluents such as from the city of Minot. Although decreases in monthly flows (about 56 percent of the time) would generally exceed increases about 24 percent of the time), the increases would generally benefit water quality.

The modified flow regime would adversely affect wetland habitat and management in the Upper Souris and J. Clark Salyer national wildlife refuges. If unmitigated, the loss of waterfowl production from the refuges and Souris River could be in the order of 21 800 ducks annually, and would be significant. The impact of such losses would not be limited to the United States but would also extend to Canada due to the sharing of the international waterfowl resource by the two countries.

The reduced flows into North Dakota would result in a decline and possible elimination of the fish population in Lake Darling. Mitigating options are limited. The change in flow regime could also increase the risk of carp invasion into North Dakota from Manitoba. This may require modifications to the J. Clark Salyer National Wildlife Refuge operating plan to minimize impacts.

Within North Dakota, the Project would have significant adverse effects on waterfowl production, particularly in the wildlife refuges, and fish resources. Complete mitigation of waterfowl impacts could be feasible, but opportunities for mitigating adverse effects on fisheries are limited.

Environmental Impacts - Manitoba

As a result of the Project, there would be an overall reduction in Souris River flows and an overall reduction in flood damages in Manitoba. The impact from flooding, however, would be increased in some rural areas where flooding occurs at relatively low water levels. This is a result of prolonged release of flood waters during flood years. Changes in the operation of national wildlife refuges in North Dakota would be required to mitigate these impacts, and improved flood forecasting would be required to reduce the agricultural losses in Manitoba. North Dakota would ensure that Manitoba receives its entitled water apportionment.

The changes in the quality of water delivered to North Dakota from Saskatchewan as a direct result of the Project would not be measurable in Manitoba due to the 660 km river reach in the United States and the complex aquatic environmental processes. The reduced flows and the hydrologic works proposed in the United States in response to the Project, would affect the quality of water in Manitoba. A reduction of water in the United States effectively means that there is less water to absorb the current level of uses, although Manitoba would still receive its entitlement according to the 1959 Measures. The degree to which quality would be changed from existing conditions has not been quantified although best professional judgment would suggest that there would be a gradual long term increase in dissolved substances and a general enhancement of the instream productivity. Any increase to instream productivity is of concern to Manitoba as the river frequently experiences overgrowth to the detriment of aesthetics and water-based recreation. Increased incidence of free ammonia would occur principally when flows would be reduced in the summer and fall relative to existing conditions.

Lower than historic annual volumes of water and altered water quality would lead to an overall decline in fisheries values in Manitoba, if compensation is not made for lost and degraded habitat. Some impact on Manitoba fisheries would be anticipated during flood years when flood peaks in Manitoba would be lower but of longer duration. This may adversely affect northern pike and perch spawning. No mitigation options were identified.

The Project is not expected to significantly impact on waterfowl productivity in the Manitoba portion of the Souris River basin. Further study is required in order to confirm this expectation.

Rare plants downstream in Manitoba would be affected to an unknown extent by altered flows in the Souris River.

As a result of the Project, moderate impacts would occur in Manitoba through increases in agricultural flooding in some reaches, increased stream productivity, additional exceedances of the Manitoba objective for free ammonia, as well as reduced fish spawning success and adverse effects on rare plant species. Most of these impacts can be mitigated, while the extent of the impact on fisheries is not fully known. Some uncertainty exists with respect to impacts on rare plant species.

Information Deficiencies

The preparation of this IEE relied primarily on the extensive documentation previously prepared by the Project Proponent (SBDA), other Saskatchewan provincial agencies, federal and state agencies in the United States, Manitoba agencies, Environment Canada and other federal government departments. Some additional data and information were compiled in the areas of hydrology, water quality, rare and endangered species and migratory birds. The lack of data and information for some areas of concern have placed limitations on the extent to which Project impacts can be assessed. The major areas of deficiency are categorized below as being of significant or moderate importance.

SIGNIFICANT DEFICIENCIES

* The basic data for Saskatchewan from 1974 to 1981 should be reviewed. The hydrology data in Saskatchewan, North Dakota and Manitoba should be updated to 1988, including data on existing and proposed water uses. These data are not required to assess the overall impact of the Project, but are critical for development of a water management plan.

* Operational criteria used in the hydrologic model have been evolving continually since the preparation of the SBDA's EIS. A water management plan must be developed which would include Saskatchewan's operations of the Project, the operation of the national wildlife refuges in North Dakota, and account for Manitoba's entitlement.

* International water quality objectives against which impacts on transboundary water quality can be assessed do not exist. If the Project proceeds, formulation of international water quality objectives should be undertaken immediately for those parameters which are considered most likely to be affected.

* The EIS's from the SBDA and the U.S. Army Corps of Engineers do not consider the collective impacts of the Project and the Souris River Basin Project on the quality of the Souris River at the North Dakota-Manitoba boundary.

* The operation of the national wildlife refuges in North Dakota affect the water quality at the North Dakota-Manitoba boundary. A precise operating plan is required to assess the water quality implications and opportunities for mitigation.

* Comprehensive mitigation and monitoring plans for waterfowl production would be required before a decision could be made on whether the Project can proceed.

* Insufficient information exists on fish habitat in the Souris River in Manitoba. As well, the significance of Lake Darling and its fish populations to the downstream reaches of the Souris River in Manitoba is unknown. Such information is required in order to accurately predict impacts of the Project on fish and to determine suitable compensation options in order to achieve 'no net loss' of productive fish habitat.

* Information and data are lacking for comparative evaluations of habitat quality in the flooded area in terms of nesting and foraging value and the surrounding range for the ferruginous hawk.

* The distribution and abundance of rare plant species in the Souris River flood plain in Saskatchewan and Manitoba needs to be studied in more detail. Particular emphasis should be placed on the reach to be inundated by the Rafferty Reservoir.

MODERATE DEFICIENCIES

* Spring flood-flow rejuvenation of the Souris River downstream of the Project would be reduced, relative to existing conditions. It is not known how the effects of this would be manifested in the aquatic ecosystem.

* The water quality models used by the proponent have not been fully field tested, calibrated or verified within the Souris River basin, although some testing was undertaken in 1989. This deficiency places some doubt upon the results.

* Data should be collected on the distribution of riparian and upland waterfowl habitat types, and on the size and composition of the resident breeding waterfowl population, along the Souris River in Manitoba. These data are required in order to substantiate the expectation that the Project would not adversely affect waterfowl production along the Souris in Manitoba.

* Quantitative baseline information is lacking on the status of Baird's sparrow in the Souris valley, particularly in the vicinity of the Rafferty and Alameda Dam site.